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FINLIB:
A FIN ENERGY ABSORPTION DATA LIBRARY FOR IMPACT ANALYSIS OF RADIOACTIVE MATERIAL TRANSPORT CASK WITH FINS

September 1997

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FINLIB: A Fin Energy Absorption Data Library for Impact Analysis of Radioactive Material Transport Cask with Fins

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In drop impact analyses for radioactive material transport cask with cooling fins, a relationship between fin plastic deformation and fin energy absoption is used. This relationship was obtained by ORNL and MONSERCO in Canada experiments. Based on ORNL experimental data, a data library computer program FINLIB for FINCRUSH program is developed to obtain the maximum impact acceleration and the maximum fin deformation.

Main features of FINLIB are as follows:

(1) not only making fin energy absorption data libraries from ORNL or MONSERCO experimental data but also comparative representations of ORNL and MONSERCO data are available,

(2) it is capable of graphical representations for fin absorption energy data and

(3) not only main frame computer but also work stations (OS UNIX) and personal computer (OS Windows) are available for use of FINLIB.

In the paper, brief illustration of calculation method in fin impact analysis based on the ORNL research is presented. The second section presents descriptions of fin energy absorption data tested at ORNL and MONSERCO. The third section provides a user's guide for computer program and input data for FINLIB.

Keywords: Computer Program, Data library, Fin Data, Energy Absorption,
Impact Analysis, Drop, Impact, Transport Cask, Cask

JAERI-Data/Code 97-035

FINLIB: フィン付き放射性物質輸送容器の衝突解析用 フィン吸収エネルギーデータライブラリー

日本原子力研究所東海研究所燃料サイクル安全工学部
幾島　毅

(1997年7月25日受理)

放熱用フィン付き放射性物質輸送容器の落下衝突解析では、米国オークリッジ国立研究所(ORNL)の研究によって得られたフィンの塑性変形量とフィンエネルギー吸収データを用いられている。このフィンエネルギー吸収データは、ORNLおよびカナダのモンセルコ社(MONSERCO)の実験によって得られている。これらのデータからのフィン付き輸送容器の落下衝突時の最大加速度とフィンの最大変形量を計算するプログラムFINCRUSHのデータライブラリー作成プログラムFINLIBを開発した。

FINLIB主要な特徴は次の通りである。

(1) ORNLとMONSERCOのそれぞれのデータからFINCRUSHに使用するデータ・ライブラリーを作成するのみならず、これらのデータの相互比較が容易にできる。

(2) フィン吸収エネルギーデータの図形表示をすることができる。

(3) 大型計算機以外にもワークステーション(OS UNIX)およびパーソナルコンピュータ(OS Windows 3.1)によっても使用できる。

本報告書はORNLの研究に基づくフィンの衝突解析法の説明、ORNLとMONSECOの実験において得られたフィンエネルギー吸収データの説明およびFINLIBプログラムおよび入力データ等のユーザーガイドについて記述したものである。

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Detail analyses of the drop impact for a radioactive transport cask with cooling fins, have become possible to perform by using interaction evaluation computer programs with a function of interaction step, such as DYNA2D, DYNA3D, PISCES and HONDO. However, considerable cost and computer time necessitate performing analyses by these programs. To decrease the computer time and cost, a simplified computer program FINCRUSH[(1)] as illustrated in Fig.1.1 has been developed[(2),(3)]. The FINCRUSH is a static calculation computer program capable of evaluating the maximum acceleration of cask bodies and the maximum fin deformation using a relationship between the fin plastic deformation and the fin absorption energy. This relationship, the fin absorption energy vs. the fin deformation data, are obtained by Davis[(4)] of ORNL and Torr[(5),(6)] of MONSERCO in Canada from experiments. The FINLIB has been developed to make data library of the fin energy absorption for the FINCRUSH.

Main features of the computer program FINLIB are as follows:

(1) not only making ORNL or MONSERCO fin energy absorption data library but also comparative representations of ORNL and MONSERCO data are available,

(2) it is capable of graphical representations for the fin energy absorption data and

(3) not only main frame computers but also work stations (OS UNIX) and personal computers (OS Windows) are available for use of FINCRUSH.

In the first section of the paper, a brief illustration of calculation method using fin energy absorption data is presented. The second section presents a description of the fin data library. The third section provides a user's guide for FINLIB.

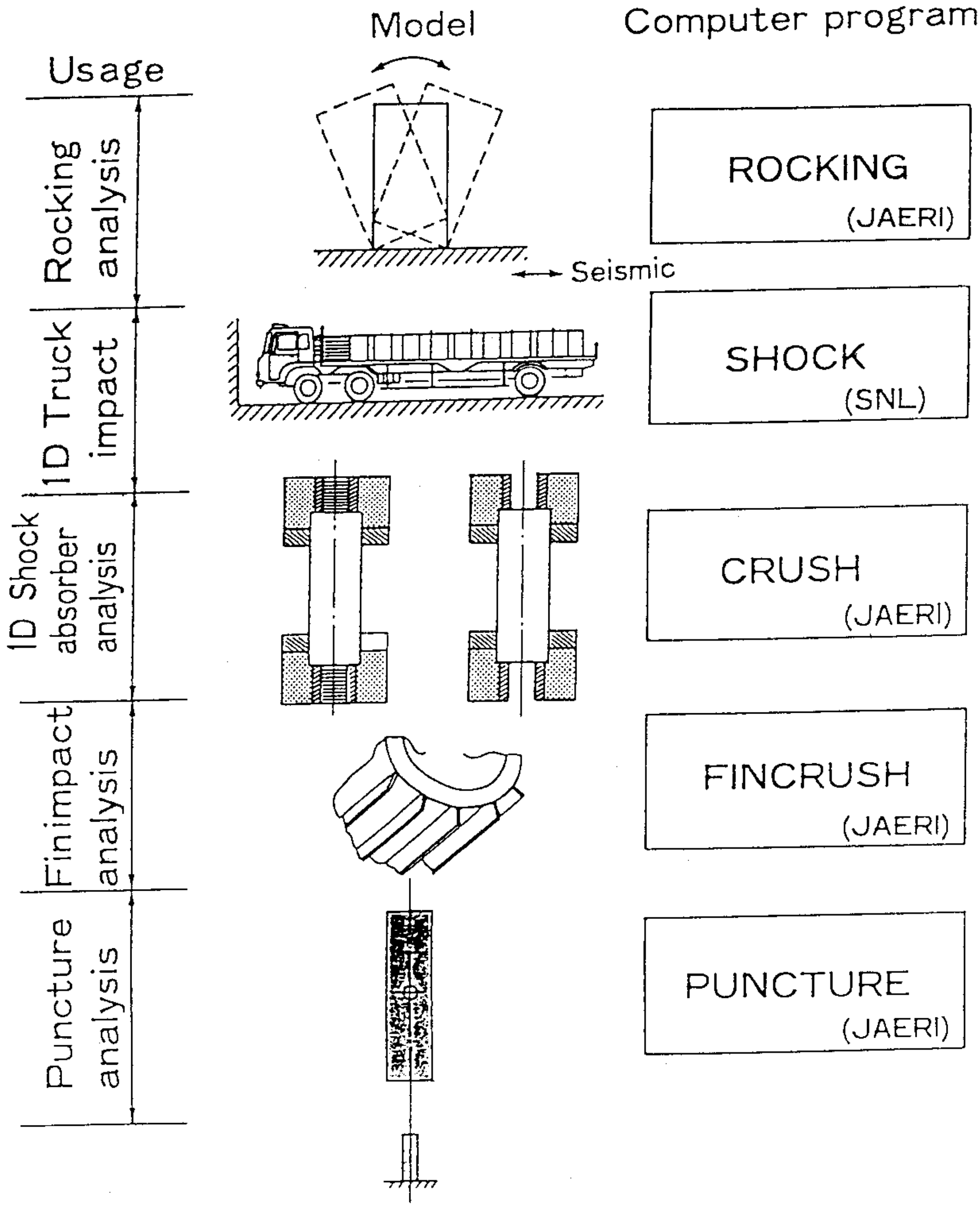


Fig. 1.1 Simplified analysis computer programs

2. Fin Data Library

2.1 Necessity of Fin Data Library

The fin energy absorption data are necessitated for impact analysis of the casks with fins usig the computer program FINCRUSH based on ORNL Davis' method[4]. In order to make the fin absorption data library from ORNL or MONSERCO fin data for FINCRUSH, the computer program FINLIB has been developed.

2.2 Calculation Method

In the modeling of a fin impact analysis program FINCRUSH, it is assumed that the static plastic moment of fins is balanced with impact energy. That is

$$E_V = W\ H_0\ , \tag{2.1}$$

where

E_V : impact energy,

W : weight of cask,

H_0 : height of cask drop.

On the other hand, absorption energy of fins is

$$E_\Phi = F\ \delta\ , \tag{2.2}$$

where

E_Φ : impact energy,

F : impact force,

δ : fin deformation.

The cask drop energy equal to the fin absorption energy. Therfore

$$E_V = E_\Phi\ . \tag{2.3}$$

The impact energy is absorbed by bending deformation of fins as shown in Fig. 2.1. The expression of the impact energy is derived from the Davis assumption. The static plastic moment may be expressed by the following equation:

$$M_p{}' = \sigma_y \left(\frac{b\ T^2}{4} \right) , \tag{2.4}$$

where

σ_y : yield stress,

b : length of fin,

T : thickness of fin,

$M_p{}'$: static plastic moment.

The static plastic moment per unit length of each of these fins is determined from the expression

$$M_p = \sigma_y \left(\frac{T^2}{4} \right) , \tag{2.5}$$

where M_p is static plastic moment per unit length. The fin absoption energy is given by

$$E_\Phi = \beta\ (\gamma)\ M_p\ b\ . \tag{2.6}$$

where β is the absorbed energy divided by the plastic moment and is written as follows:

$$\beta(\gamma) = E_\Phi\ /\ (M_p\ b)\ . \tag{2.7}$$

In the other words, β is a constant depending the fin absorption energy and the fin plastic moment obtained by Davis and Torr. In the data curve, β is shown on the ordinate and γ on the abcissa. The fin deformation ratio is defined by

$$\gamma = \delta_\Phi\ /\ H\ , \tag{2.8}$$

where

γ : fin deformation ratio,

δ_Φ : fin deformation,

H : fin height.

In the case of the inclined fin, the deformation of the fin is given by the following equation as shown in Fig. 2.2,

$$\delta_\Phi = R_0 - \frac{R_0 - \delta_0}{\cos\Phi} , \tag{2.9}$$

where

δ_Φ : fin deformation,

R_0 : outer radius of fin,

ϕ : attached angle of fin.

The fin deformation of the inclined fin is given by

$$\delta_0 = R_0 \cos\theta . \tag{2.10}$$

Davis and Torr present the fin absorption energy data as a function of the fin deformation ratio as shown in Figs 2.3 through 2.22. Therfore, the absorption energy in the case of fin impact is given by the following equation (see Eq. 2.6):

$$E_\Phi = \beta (\gamma) M_p b . \tag{2.11}$$

The force of the cask body is may be expressed by the following equation:

$$F = dE_\Phi / d\delta_\Phi . \tag{2.12}$$

The acceleration of the cask body is determined by the following formula:

$$\alpha = F / (W / g) , \tag{2.13}$$

where

α : acceleration of cask body,

g : gravity constant.

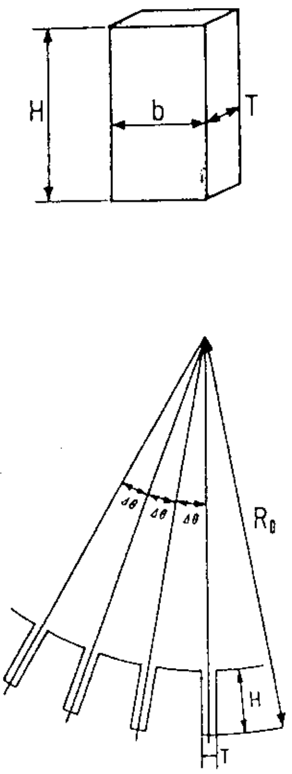


Fig. 2.1 Fin geometry

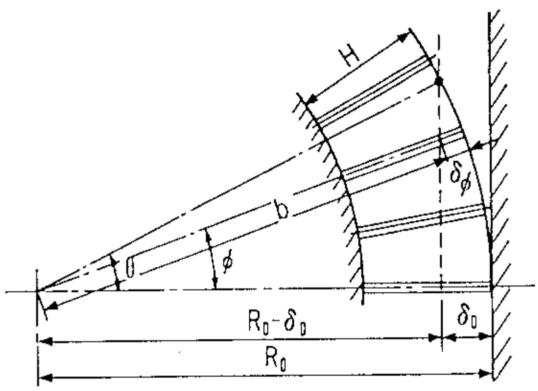


Fig. 2.2 Relationship between fin displacement and angle

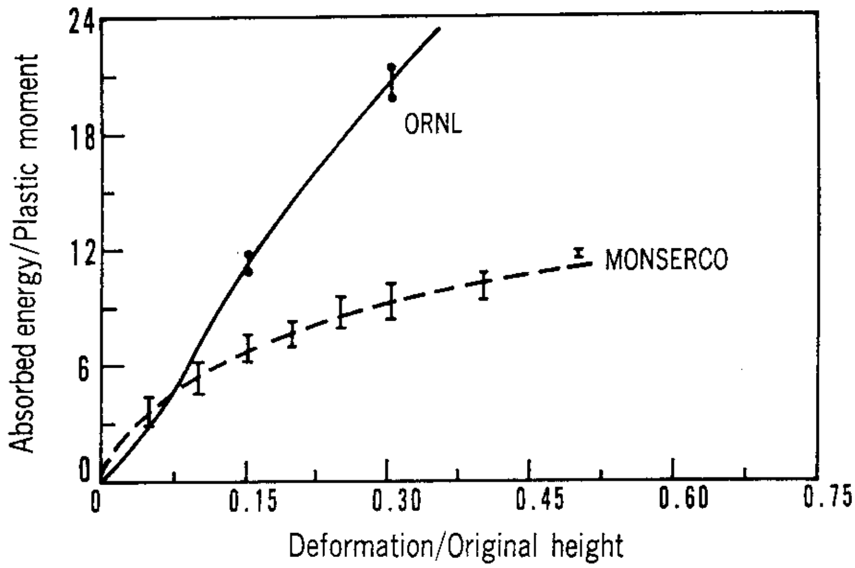


Fig. 2.3 Absorbed energy vs. deformation ratio of fin

Fin height	:	3.5 in. (89mm)
Inclination angle	:	0 degree

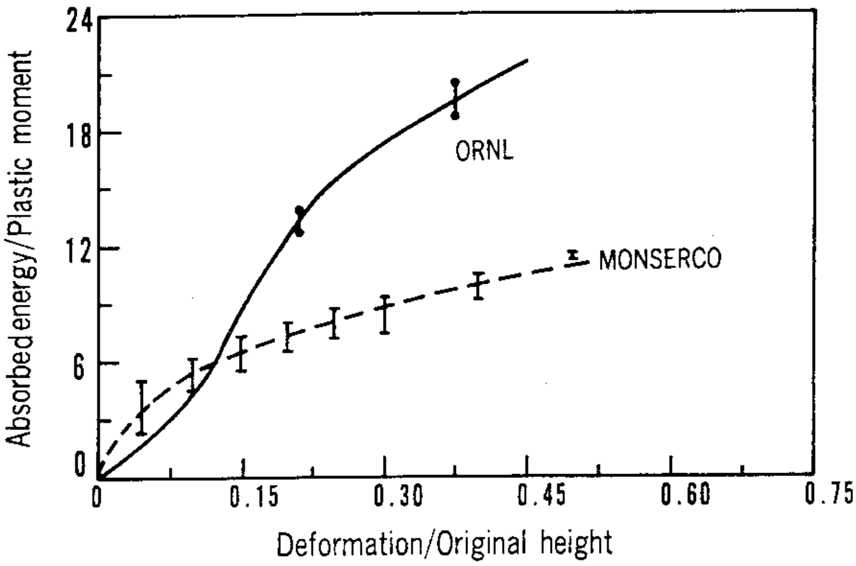


Fig. 2.4 Absorbed energy vs. deformation ratio of fin

Fin height	:	4.0 in. (102mm)
Inclination angle	:	0 degree

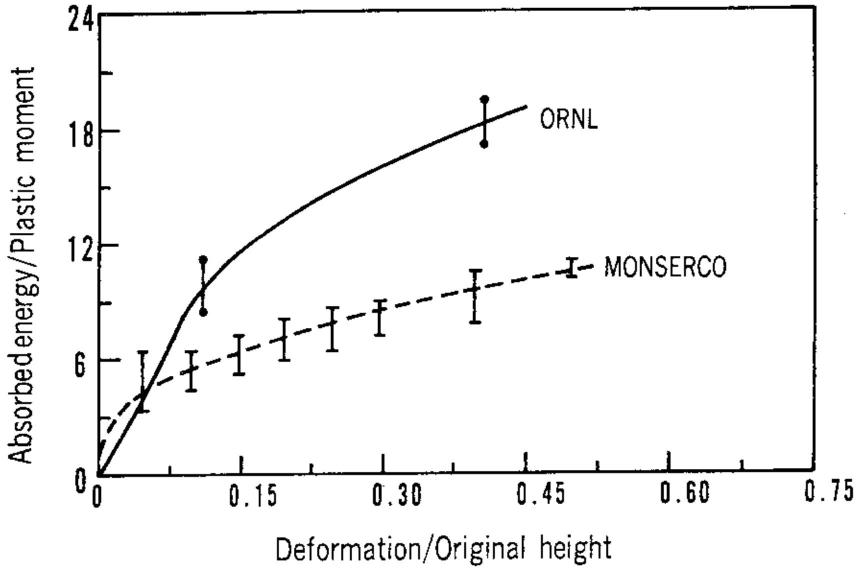


Fig. 2.5 Absorbed energy vs. deformation ratio of fin

[Fin height : 6.0 in. (152mm)
Inclination angle : 0 degree]

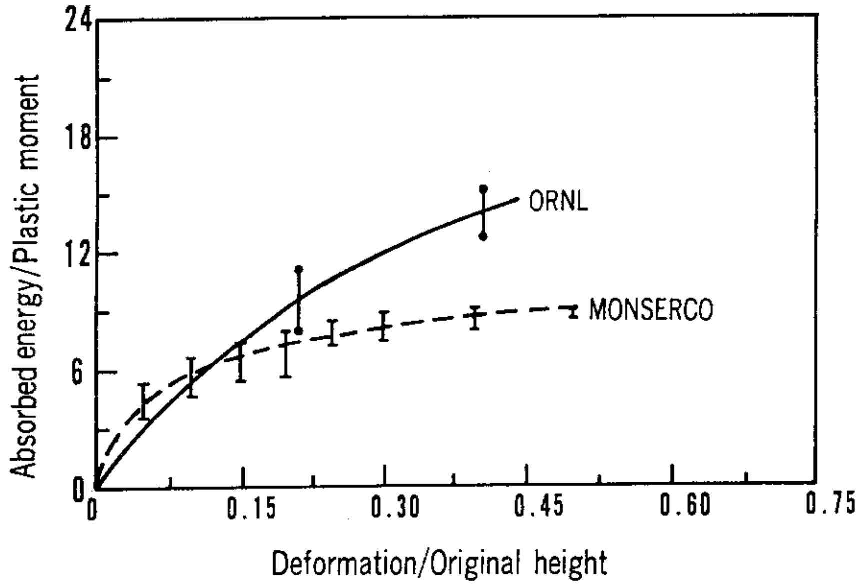


Fig. 2.6 Absorbed energy vs. deformation ratio of fin

[Fin height : 8.0 in. (203 mm)
Inclination angle : 0 degree]

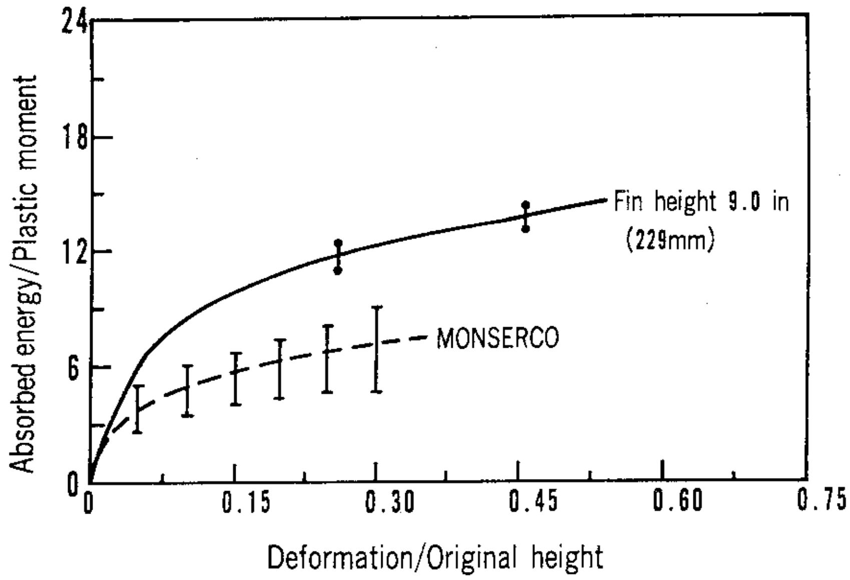


Fig. 2.7 Absorbed energy vs. deformation ratio of fin

Fin height	:	10.0 in. (254mm)
Inclination angle	:	0 degree

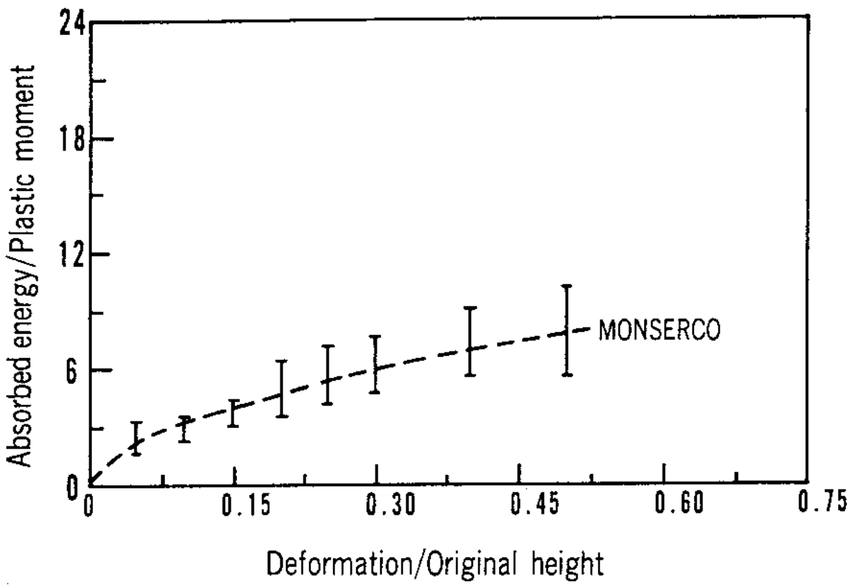


Fig. 2.8 Absorbed energy vs. deformation ratio of fin

Fin height	:	3.5 in. (89mm)
Inclination angle	:	10 degree

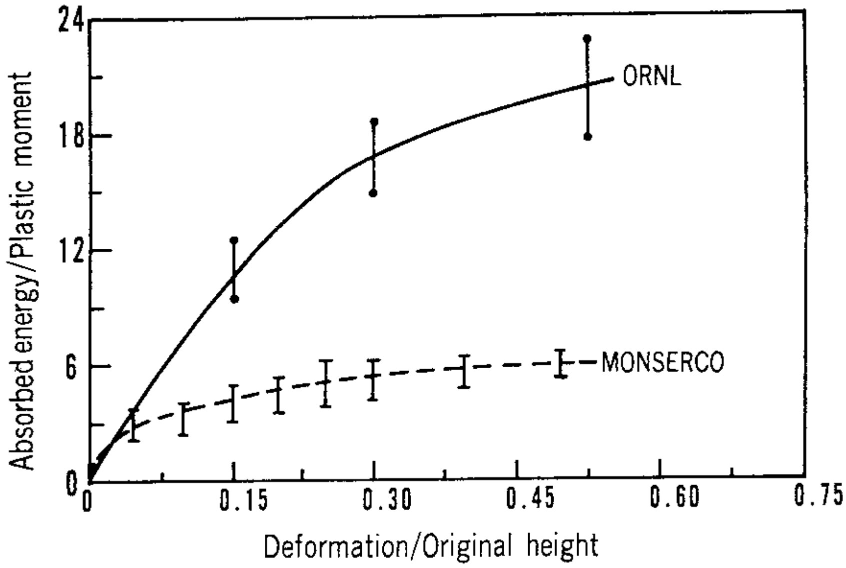


Fig. 2.9 Absorbed energy vs. deformation ratio of fin

Fin height	:	4.0 in. (102mm)
Inclination angle	:	10 degree

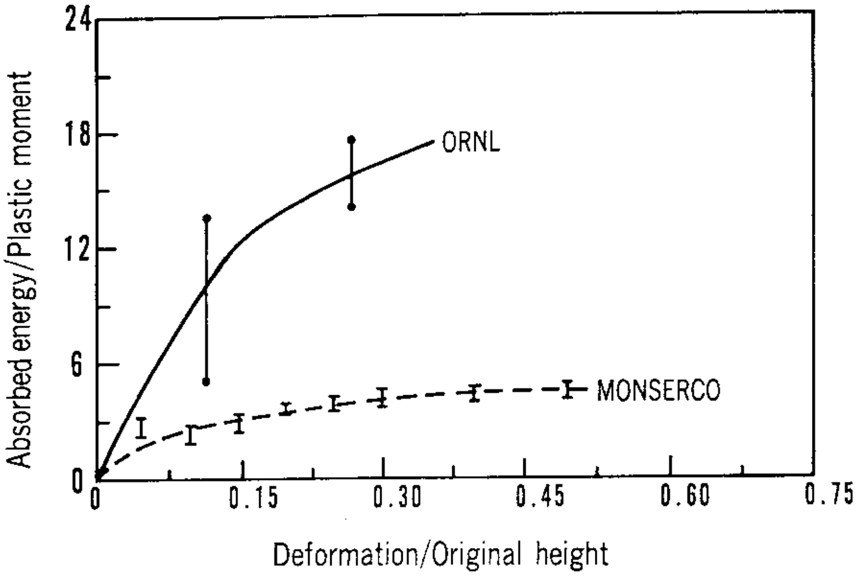


Fig. 2.10 Absorbed energy vs. deformation ratio of fin

Fin height	:	6.0 in. (152mm)
Inclination angle	:	10 degree

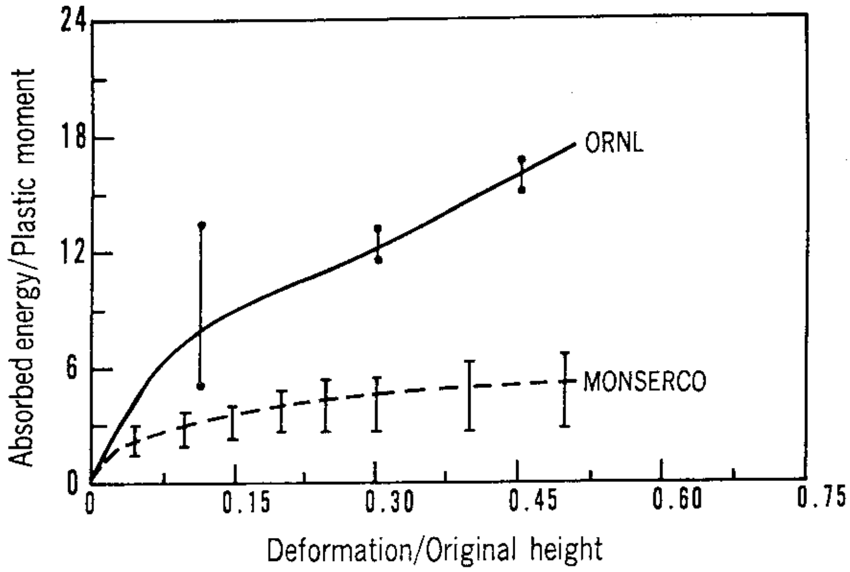


Fig. 2.11 Absorbed energy vs. deformation ratio of fin

Fin height	:	8.0 in. (203mm)
Inclination angle	:	10 degree

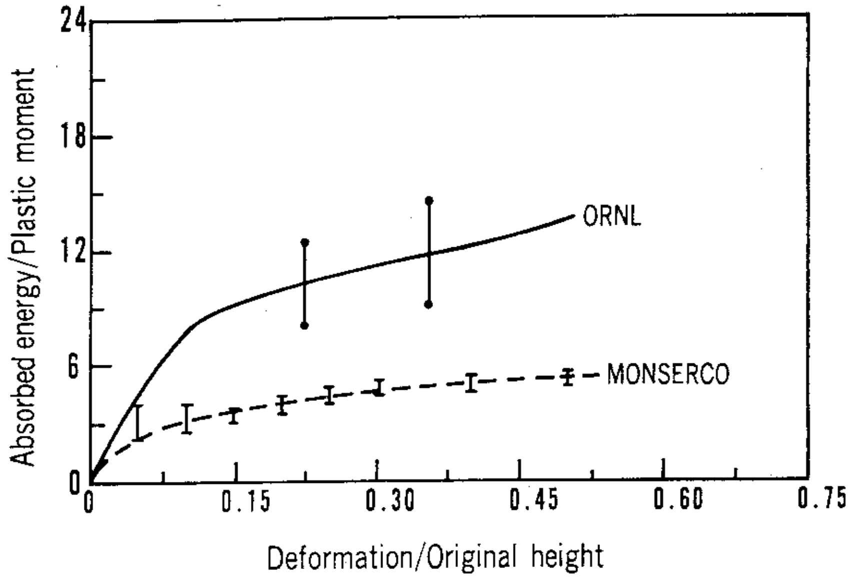


Fig. 2.12 Absorbed energy vs. deformation ratio of fin

Fin height	:	10.0 in. (254mm)
Inclination angle	:	10 degree

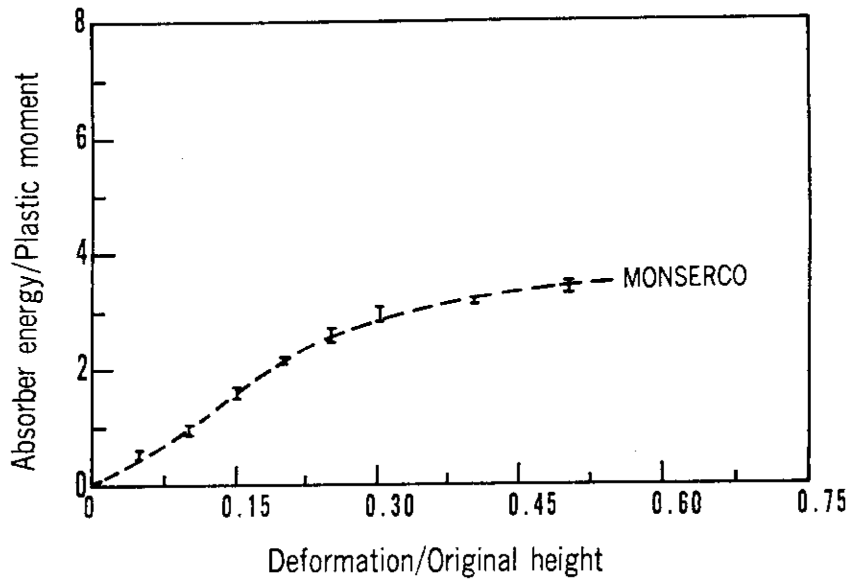


Fig. 2.13 Absorbed energy vs. deformation ratio of fin

[Fin height : 3.5 in. (89mm)
Inclination angle : 20 degree]

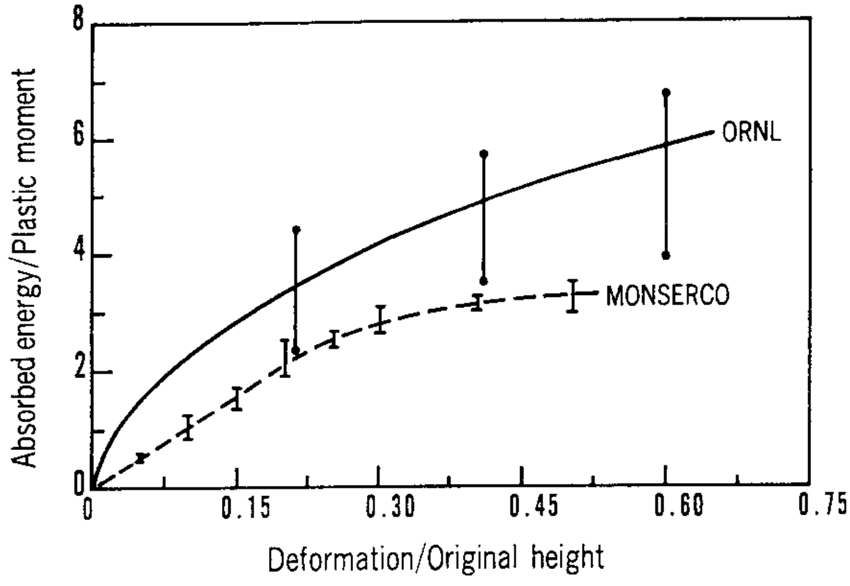


Fig. 2.14 Absorbed energy vs. deformation ratio of fin

[Fin height : 4.0 in. (102mm)
Inclination angle : 20 degree]

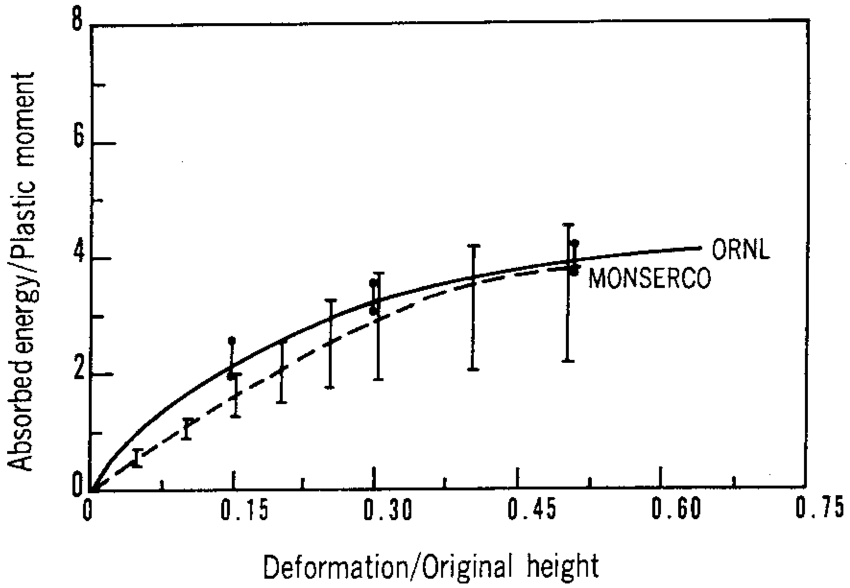


Fig. 2.15 Absorbed energy vs. deformation ratio of fin

[Fin height : 6.0 in. (152mm)
Inclination angle : 20 degree]

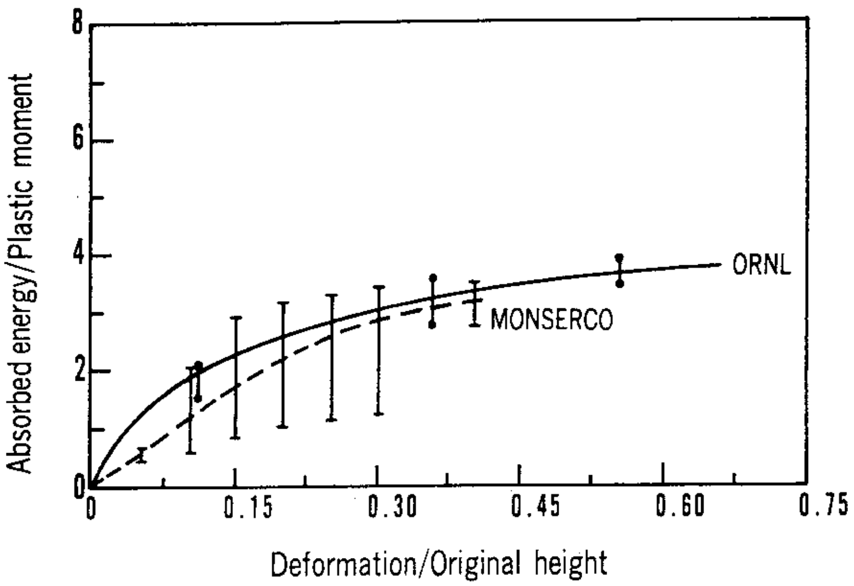


Fig. 2.16 Absorbed energy vs. deformation ratio of fin

[Fin height : 8.0 in. (203mm)
Inclination angle : 20 degree]

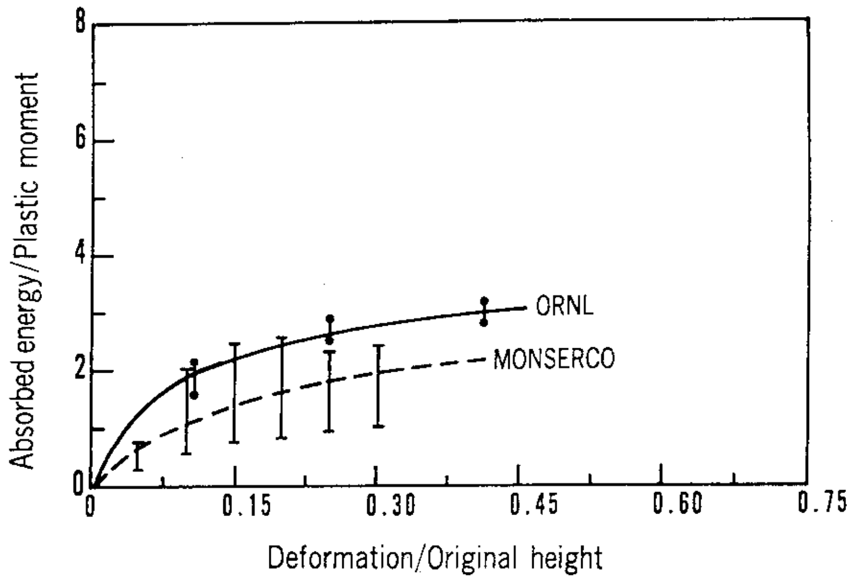


Fig. 2.17 Absorbed energy vs. deformation ratio of fin

Fin height	:	10 in. (254mm)
Inclination angle	:	20 degree

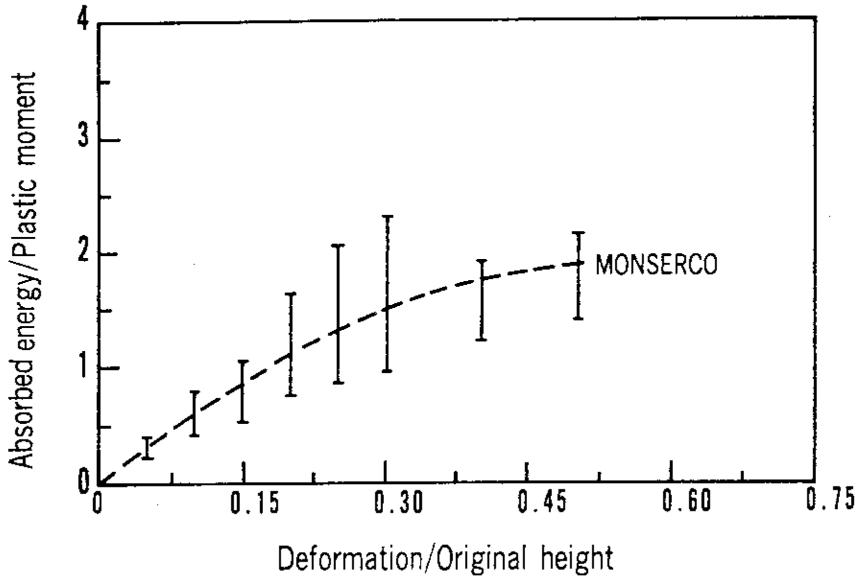


Fig. 2.18 Absorbed energy vs. deformation ratio of fin

Fin height	:	3.5 in. (89mm)
Inclination angle	:	30 degree

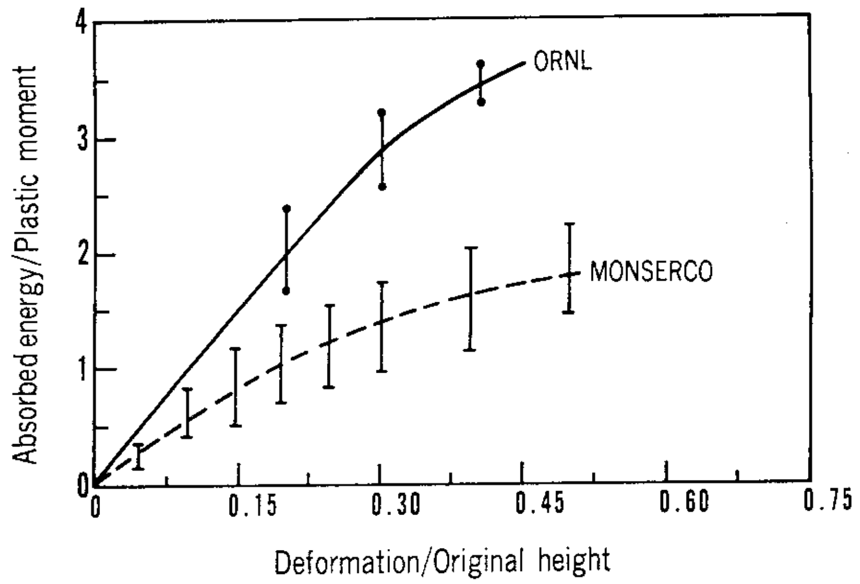


Fig. 2.19 Absorbed energy vs. deformation ratio of fin

[Fin height : 4.0 in. (102mm)
Inclination angle : 30 degree]

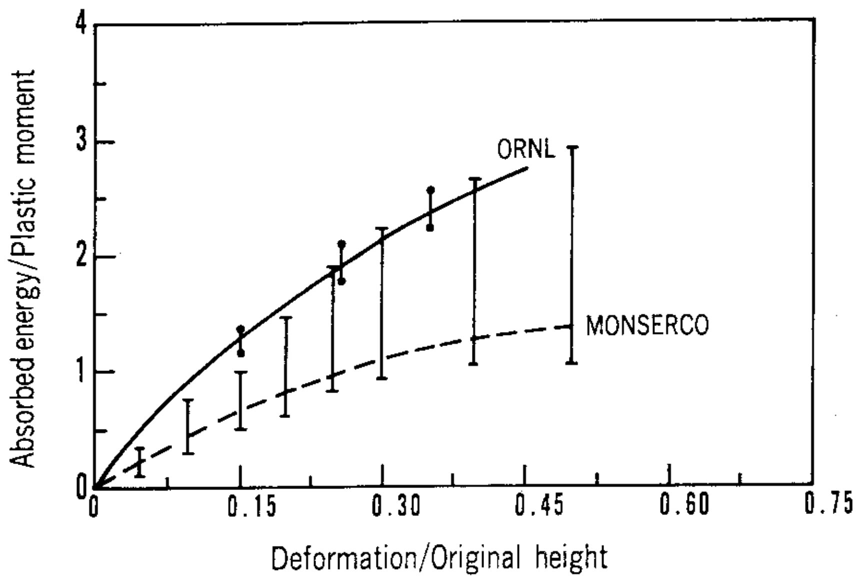


Fig. 2.20 Absorbed energy vs. deformation ratio of fin

[Fin height : 6.0 in. (152mm)
Inclination angle : 30 degree]

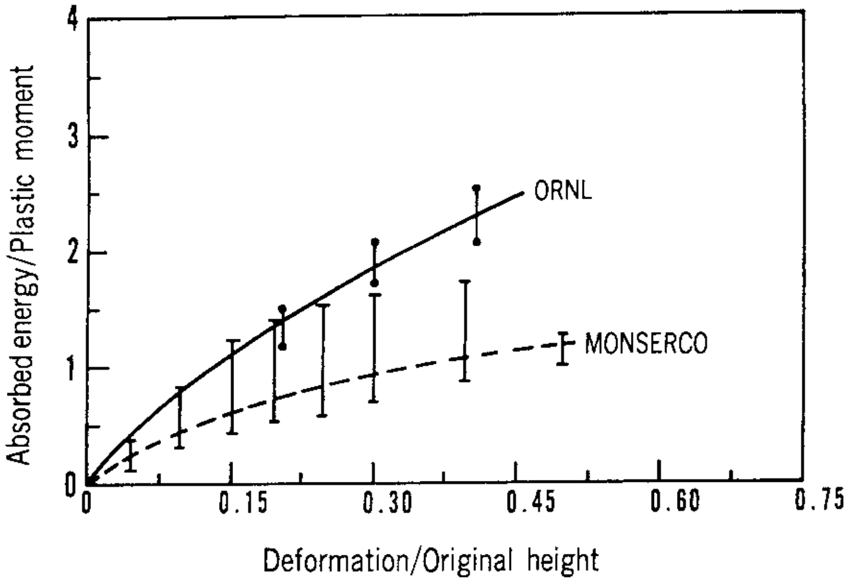


Fig. 2.21 Absorbed energy vs. deformation ratio of fin

Fin height	:	8.0 in.(203mm)
Inclination angle	:	30 degree

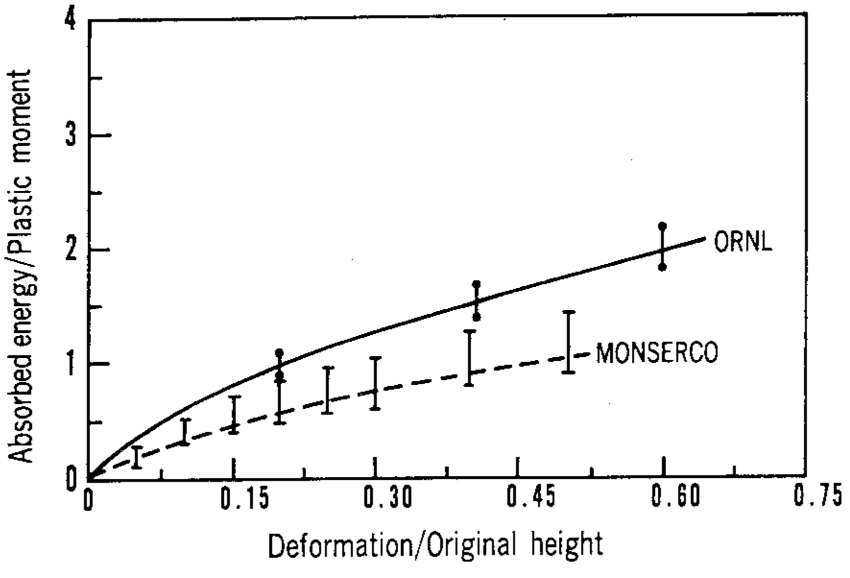


Fig. 2.22 Absorbed energy vs. deformation ratio of fin

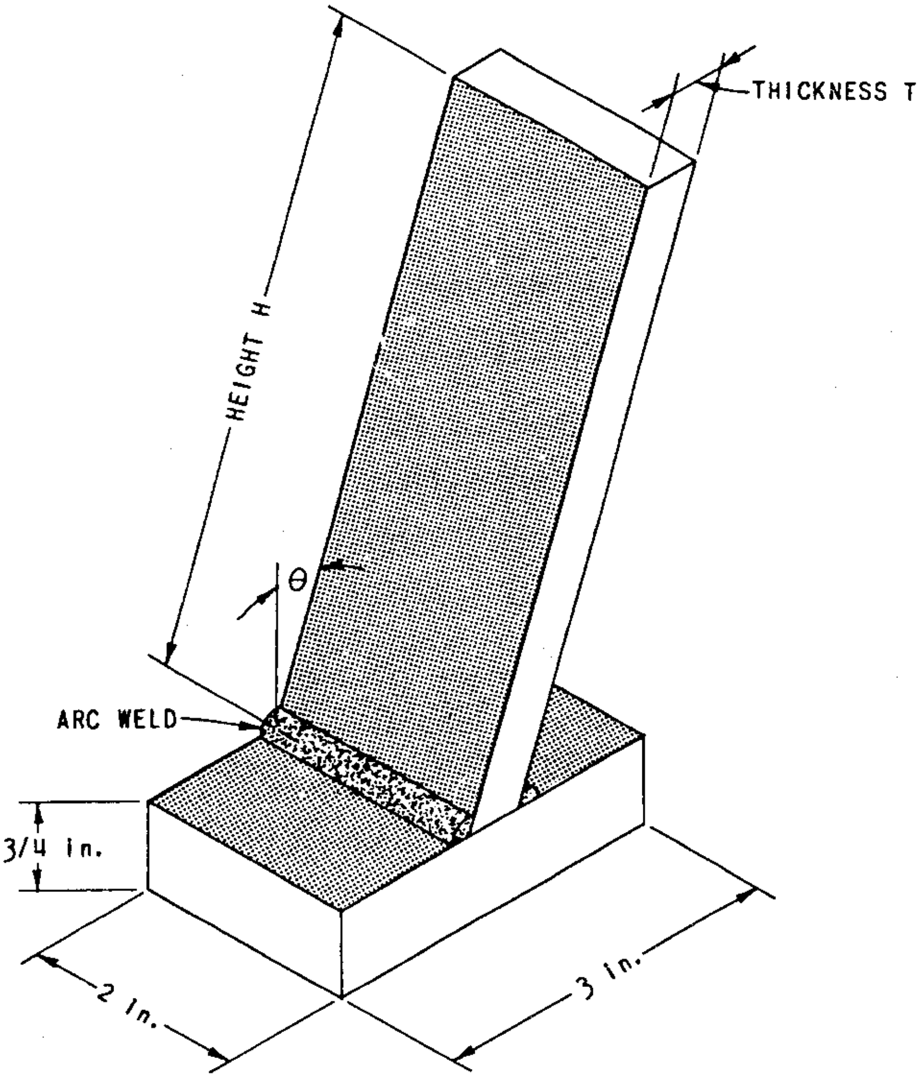
Fin height	:	10.0 in.(254mm)
Inclination angle	:	30 degree

3.Description of Data Library

One of the most widely used fin data sets of design curves comes from impact experiments done in 1971 by Davis of ORNL. His investigation measured the impact performance of single fins 2 inches (50.8 mm) wide varying in length from 3.5 to 10 inches (88.9 to 254 mm), in thickness from 1/4 to 3/4 inches (6.4 to 19.1 mm) and an angle of inclination to the impact direction from 0 to 40 degrees as shown in Fig. 3.1.

In the MONSERCO experiments six kinds of fins were used as shown in Table 3.1 and Fig. 3.2. Test fins were of two thickness, in thickness from 1/4 inches (6.4 mm) and 3/8 inches (9.5 mm), and of five different lengths between 3.5 to 10 inches (88.9 to 254 mm). The single fins had four different angles of inclination; 0, 10, 20 and 30 degrees from the vertical.

In this data library there are eleven data base as shown in Table 3.2. Those data are obtained by ORNL and MONSERCO.



T (in.)	θ = 0°					10°				20°				30°				40°			
H (in.)	3½	4	6	8	9	4	6	8	10	4	6	8	10	4	6	8	10	4	6	8	10
1/4		X	X				X	X	X		X	X	X		X	X	X		X	X	X
3/8						X	X	X	X	X	X	X	X	X	X	X		X	X	X	X
1/2	X		X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
5/8							X	X	X	X	X	X	X	X	X	X		X	X	X	X
3/4			X		X	X	X	X	X	X	X	X	X	X	X		X	X	X	X	X

Fig. 3.1 Dimensions of fin specimen tested at ORNL

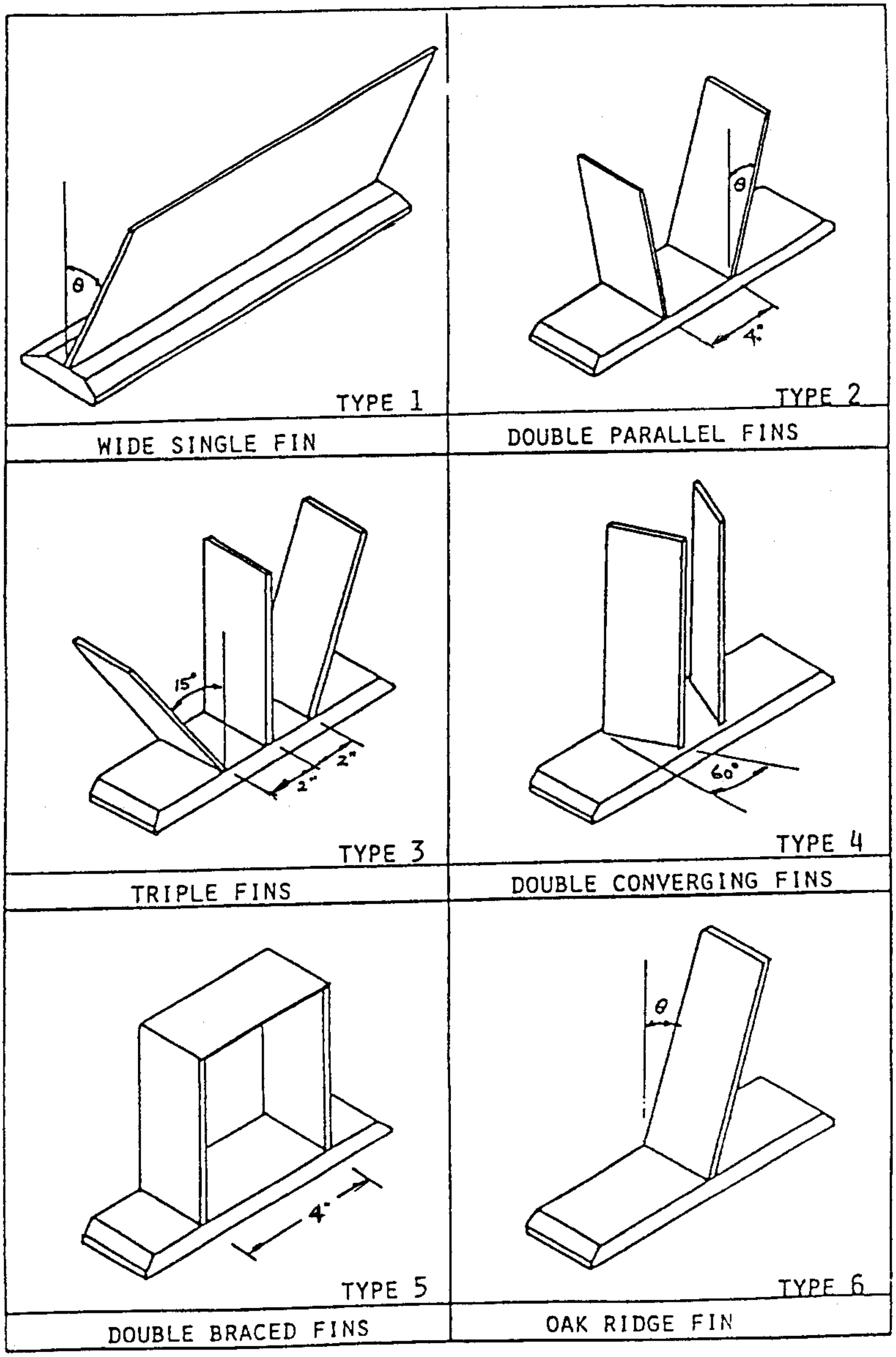


Fig. 3.2 Configuration of fins tested at MONSERCO

Table 3.1 Dimensions of fin specimens tested at MONSERCO

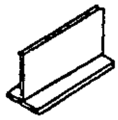
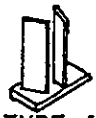
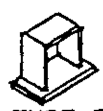
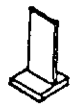
FIN ANGLE OF INCLINATION (degrees)	FIN LENGTH (inches)	 TYPE 1	 TYPE 2	 TYPE 3	 TYPE 4	 TYPE 5	 TYPE 6
0°	3.5	X	X	(X)	X	X	X
	4.0	X	X	(X)	X	X	X
	6.0	X	X	(X)	X	X	X
	8.0	X	X	(X)	X	X	X
	10.0	X	X	(X)	X	X	X
10°	3.5	X	X				
	4.0	X	X				
	6.0	X	X				
	8.0	X	X				
	10.0	X	X				
15°	3.5			(X)			
	4.0			(X)			
	6.0			(X)			
	8.0			(X)			
	10.0			(X)			
20°	3.5	X	X				
	4.0	X	X				
	6.0	X	X				
	8.0	X	X				
	10.0	X	X				
30°	3.5	X	X				X
	4.0	X	X				X
	6.0	X	X				X
	8.0	X	X				X
	10.0	X	X				X

Table 3.2 Data library of FINLIB

Research organization	Identification name	Descriptions
ORNL	ORNL	ORNL single fin (mean values)
	OHIG	ORNL single fin (higher values)
	OLOW	ORNL single fin (lower values)
MONSERCO	MEAN	MONSERCO single fin (mean values)
	MHIG	MONSERCO single fin (higher values)
	MLOW	MONSERCO single fin (lower values)
	MWID	MONSERCO wide single fin
	MPAR	MONSERCO double parallel fin
	MCON	MONSERCO double converging fin
	MBRA	MONSERCO double braced fin
	MOAK	MONSERCO Oak Ridge type single fin

4. Computer Program

4.1 Program Description

The computer program FINLIB consists of three parts. They are the fin energy absorption data obtained by ORNL and MONSERCO, the data library making program and the plotting program for data library for the computer program FINCRUSH. The FINCRUSH is static calculation program capable of evaluating the maximum acceleration of the cask body and the maximum fin deformation using relationship between fin plastic deformation and fin energy absoption based on experimental data.

The computer program FINLIB consists of a main routine and nine subroutines those are MAIN, READLB, GETCMD, GETDAT, SEQENT, QQSORT, TOFIN, TORNG, KPLOTX and KPLOT. The eleven basic subroutines for plotting are GSCAL3, XYSCAL, PLTBGN, PLPEN, PLINES, PLMARK, PSYM, PNUMB, PNUMBB, PLTEOR and PLREND. An overall structure of FINLIB is shown in Fig. 4.1. Functions of subroutines are as follows:

MAIN : initializes start of run,

READLB : reads fin energy absorption data obtained by ORNL and MONSERCO,

GETCMD : reads input data for plotting,

GETDAT : reads input data for making fin energy absorptionon library,

SEQENT : sorts out fin energy absorption data (1),

QQSORT : sorts out fin energy absorption data (2),

TOFIN : makes library of fin energy absorption data for an use of FINCRUSH program,

TORNG : prints out fin energy absorption library,

KPLOTX : controls plotting,

KPLOT : plots fin energy absorption library.

The plot basic subroutines are as follows:

GSCAL3 : gives scaling of geometry plot,

XYSCAL : gives scaling of X-Y plot

PLTBGN : initiatizes of plotter,

PLPEN : changes plotter pen size,

PLINES : draws line,

PLMARK : plots round mark,

PSYM : writes letter,

PNUMB : writes number,

PNUMBB : writes number,

PLTEOR : plots new figure,

PLTEND : plots end.

A macroscopic flow chart of FINLIB is shown in Fig. 4.2.

4.2 Description of Input Data

This section describes the input data required by FINLIB. The input data consists of the job description, the fin type selection, geometry selection and options for output plotting. The input instruction is simple and easy to follow. The input data form are presented in Table 4.1. The data formats of the fin energy absorption data are listed in Table 4.2.

4.3 Description of Output Data

This section describes the output data form of FINLIB. The contents of these various quantities are described in the followings.

(1) Input data

The input data are printed in two formats. The first print format is exactly the same as they were read. Second, the computer program lists the input data as interpreted by FINLIB.

(2) Fin energy absorption data

The fin energy absorption data are compiled in data library file and printed out on output sheets.

(3) Graphical output

The FINLIB provides users with graphical output of the fin energy absorption library.

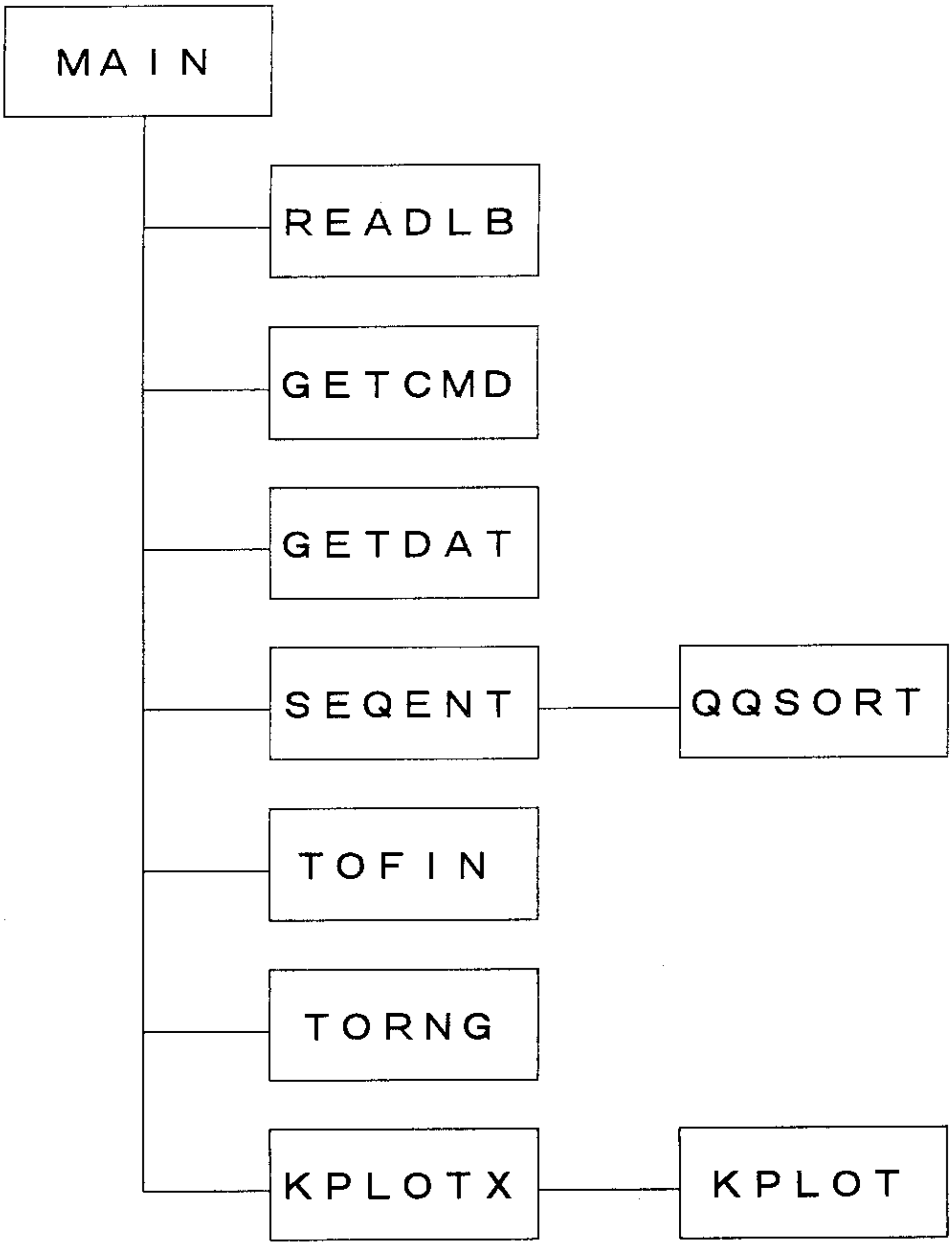


Fig. 4.1 Structure of computer program FINLIB

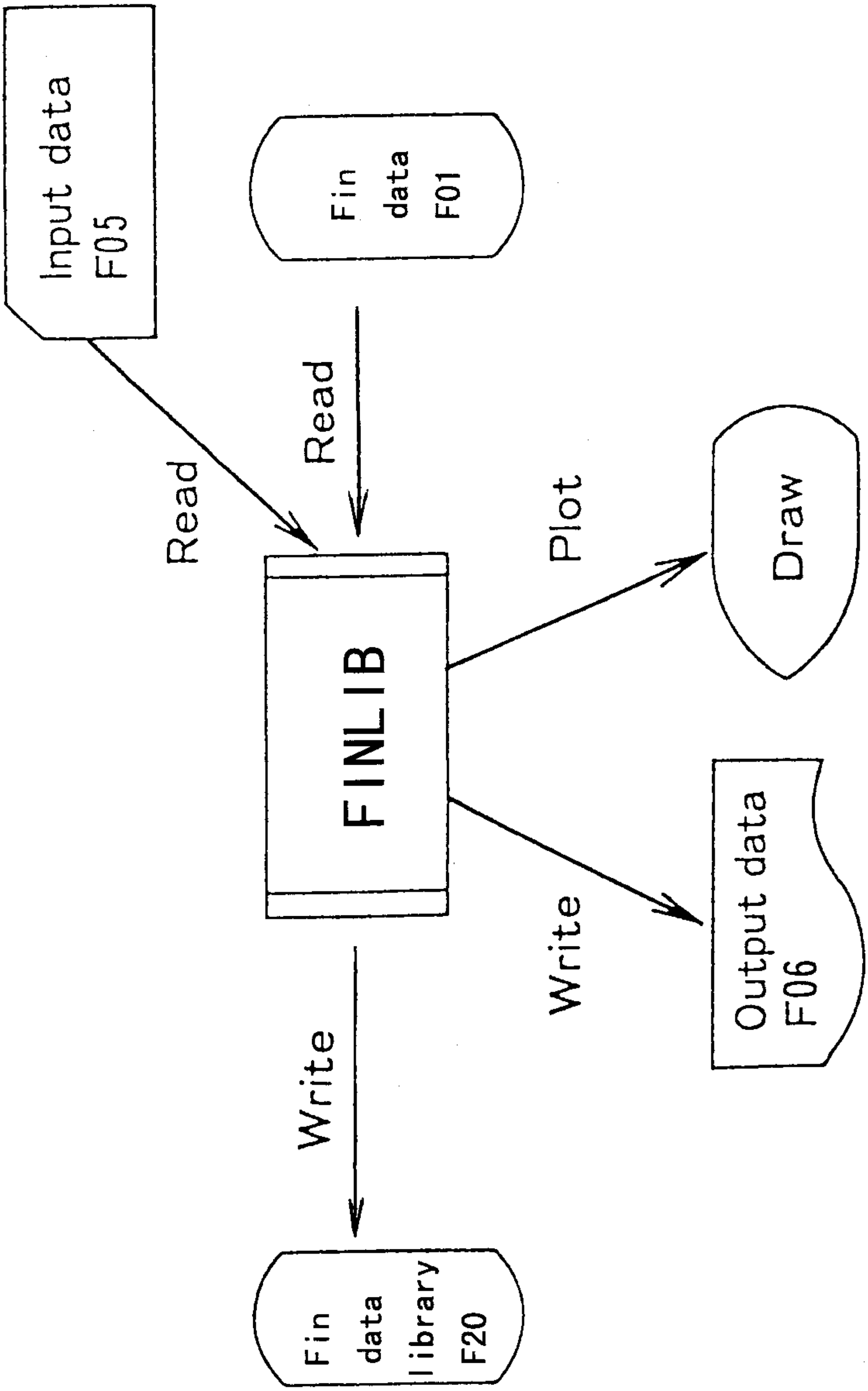


Fig. 4.2 Program flow

Table 4.1 Input data for FINLIB

Data No.	Format	Variables	Descriptions
Data set No. 1 : TITLE command.			
1st data	A5	NFLAG	Flag for data type. 'TITLE' : flag for job description.
2nd data	7A8	NTITLE	Job description.
Data set No. 2 : KEY command.			
1st data	A3	NFLAG	Flag for data type. 'KEY' : flag for fin data.
2nd data	A4	NAME	Flag for fin data identification. 'MWID' : MONSERCO wide single fin. 'MPAR' : MONSERCO double pararell fin. 'MCON' : MONSERCO double converging fin. 'MBRA' : MONSERCO double braced fin. 'MOAK' : MONSERCO ORNL single fin. 'MEAN' : MONSERCO ORNL single fin(mean values). 'MHIG' : MONSERCO ORNL single fin(higher values). 'MLOW' : MONSERCO ORNL single fin(lower values). 'ORNL' : ORNL single fin(mean values). 'OHIG' : ORNL single fin(higher values). 'OLOW' : ORNL single fin(lower values).
3rd data		KYANG	Attached angle of fin(degrees). 'ANGLE=0.0' : 0.0 degree. 'ANGLE=10.0' : 10.0 degrees. 'ANGLE=20.0' : 20.0 degrees. 'ANGLE=30.0' : 30.0 degrees. 'ANGLE=40.0' : 40.0 degrees.

Table 4.1 (Continued)

Columns	Format	Variables	Descriptions
4th data		KYLENG	Fin length(inch.). 'LENGTH=3.5' : 3.5 inches. 'LENGTH=4.0' : 4.0 inches. 'LENGTH=6.0' : 6.0 inches. 'LENGTH=8.0' : 8.0 inches. 'LENGTH=10.0' : 10.0 inches.
5th data		KYTICK	Fin thickness(inch. dummy data). 'THICK=1.234' : 1.234 inches.
Data set No. 3 : ADD command.			
1st data	A3	NFLG	Flag for data type. 'ADD' : flag for comparative representation' of fin data.
2nd data	A4	NAME1	Flag for fin data identification.
3rd data	A4	NAME2	'MWID' : MONSERCO wide single fin.
4th data	A4	NAME3	'MPAR' : MONSERCO double pararell fin.
5th data	A4	NAME4	'MCON' : MONSERCO double converging fin.
6th data	A4	NAME5	'MBRA' : MONSERCO double braced fin. 'MOAK' : MONSERCO ORNL single fin. 'MEAN' : MONSERCO ORNL single fin(mean values). 'MHIG' : MONSERCO ORNL single fin(higher values). 'MLOW' : MONSERCO ORNL single fin(lower values). 'ORNL' : ORNL single fin(mean values). 'OHIG' : ORNL single fin(higher values). 'OLOW' : ORNL single fin(lower values).

Table 4.1 (Continued)

Columns	Format	Variables	Descriptions
Data set No. 4 : WRITE command.			
1st data	A5	NFLAG	Flag for data type. 'WRITE' : flag for writing file of fin energy absorption data.
2nd data	A4	NAME	Flag for fin data identification. 'MWID' : MONSERCO wide single fin. 'MPAR' : MONSERCO double pararell fin. 'MCON' : MONSERCO double converging fin. 'MBRA' : MONSERCO double braced fin. 'MOAK' : MONSERCO ORNL single fin. 'MEAN' : MONSERCO ORNL single fin(mean values). 'MHIG' : MONSERCO ORNL single fin(higher values). 'MLOW' : MONSERCO ORNL single fin(lower values). 'ORNL' : ORNL single fin(mean values). 'OHIG' : ORNL single fin(higher values). 'OLOW' : ORNL single fin(lower values).
Data set No. 5 : PLOT command.			
1st data	A4	NAME	Flag for fin data. 'PLOT' : flag for data plot.
2nd data	I1	MPLOT	Kind of plotting data. 1 : ordinary use(see Fig. C.1 through C.5). 6 : comparison between data libraries(see Fig. C.6 through C.22).

Table 4.1 (Continued)

Columns	Format	Variables	Descriptions
Data set No. 5 : END command.			
1st data	A3	NFLAG	Flag for data type. 'END' : flag for job end.

Table 4.2 Format for fin energy absorption data

Data No.	Format	Variables	Descriptions
Data set No. 1 : TITLE command.			
1	A1	NFLAG	Flag for data partition. ':' : flag for data partition.
Data set No. 2 : KEY command.			
1 - 4	A4	NAME	Flag for fin data identification. 'MWID' : MONSERCO wide single fin. 'MPAR' : MONSERCO double pararell fin. 'MCON' : MONSERCO double converging fin. 'MBRA' : MONSERCO double braced fin. 'MOAK' : MONSERCO ORNL single fin. 'MEAN' : MONSERCO ORNL single fin(mean values). 'MHIG' : MONSERCO ORNL single fin(higher values). 'MLOW' : MONSERCO ORNL single fin(lower values). 'ORNL' : ORNL single fin(mean values). 'OHIG' : ORNL single fin(higher values). 'OLOW' : ORNL single fin(lower values).
5 - 6	I2	KYANG	Attached angle of fin(degrees). '00' : 0 degree. '10' : 10 degrees. '20' : 20 degrees. '30' : 30 degrees. '40' : 40 degrees. etc.

Table 4.2 (Continued)

Columns	Format	Variables	Descriptions
7 - 8		KDELTA	Fin deformation ratio(percent). '05' : 5 percents. '10' : 10 percents. '15' : 15 percents. '20' : 20 percents. '25' : 25 percents. '30' : 30 percents. '35' : 35 percents. '40' : 40 percents. etc.
9 - 12	I4	KYLENG	Fin length(inch). '0350' : 3.5 inches. '0400' : 4.0 inches. '0600' : 6.0 inches. '0800' : 8.0 inches. '1000' : 10.0 inches. etc.
13 - 16	I4	KYTICK	Fin thickness(inch. dummy for ORNL data). '1234' : 1.234 inches.
17 - 20	I4	KAVERG	Fin energy absorption ratio(Absorbed energy/ Plastic moment). '1234' : 12.34. '0012' : 0.12. etc.
21 - 24	I4	KDEVAT	Deviation of fin energy absorption ratio (Absorbed energy/Plastic moment). '1234' : 12.34. '0012' : 0.12.

5. Conclusions

With regard to the evaluation of the maximum acceleration for the cask bodys and the maximum deformation of the fin on the drop impact, a simplified computer program FINCRUSH will analyze it economically and by save computer time as compared with the other detailed computer programs with a analysis method of dynamic interactions. The FINLIB is further being utilized satisfactory in making the fin absorption data library for FINCRUSH program using ORNL and MONSERCO experimental data.

Acknowledgements

The author is indebted to Dr. Kazuo Asada of Mitubishi Heavy Industries, Ltd. for providing the sample problems and valuable discussions. He is also indebted to Mr. Yutaka Hasegawa, Junji Oshika and Takashi Ishiwata of CRC Research Institute, Inc. for assistance of making the computer program.

5. Conclusions

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Appendix A Sample Problem Input

```
                         INPUT DATA ECHO

         1         2         3         4         5         6         7         8
----5----0----5----0----5----0----5----0----5----0----5----0----5----0----5----0

TITLE   ORNL FIN ENERGY ABSORPTION DATA
KEY     NAME=ORNL   ANGLE=0.0    THICK=1.234
PLOT  1
KEY     NAME=ORNL   ANGLE=10.0   THICK=1.234
PLOT  1
KEY     NAME=ORNL   ANGLE=20.0   THICK=1.234
PLOT  1
KEY     NAME=ORNL   ANGLE=30.0   THICK=1.234
PLOT  1
KEY     NAME=ORNL   ANGLE=40.0   THICK=1.234
PLOT  1
WRITE   ORNL
END

----5----0----5----0----5----0----5----0----5----0----5----0----5----0----5----0
         1         2         3         4         5         6         7         8

     * * *  INPUT DATA END  * * *
```

Appendix B Sample Problem Output

```
         1         2         3         4         5         6         7         8
----5----0----5----0----5----0----5----0----5----0----5----0----5----0----5----0

MATERIAL            1     FIN ENERGY ABSORPTION DATA
THICKNESS   31.3436
ANGLE        0.0000 5
FINH        88.9000 8
    0.0000   0.0500 0.1000    0.1500    0.2000    0.2500    0.3000    0.3500
    0.0000   2.5700 7.0000   11.1400   14.4300   17.8600   20.5700   23.5700
FINH       101.6000 10
    0.0000   0.0500 0.1000    0.1500    0.2000    0.2500    0.3000    0.3500
    0.4000   0.4500
    0.0000   1.7100 4.0000    8.5700   12.5700   15.2900   17.0000   18.4300
   19.7900  21.1400
FINH       152.4000 10
    0.0000   0.0500 0.1000    0.1500    0.2000    0.2500    0.3000    0.3500
    0.4000   0.4500
    0.0000   4.1400 9.0000   11.7100   13.4300   15.1400   16.1400   17.1400
   18.1400  19.1400
FINH       203.2000 10
    0.0000   0.0500 0.1000    0.1500    0.2000    0.2500    0.3000    0.3500
    0.4000   0.4500
    0.0000   3.0000 5.5700    7.4300    9.4300   11.0000   12.0000   13.0000
   13.7100  14.2900
FINH       228.5999 10
    0.0000   0.0500 0.1000    0.1500    0.2000    0.2500    0.3000    0.3500
    0.4000   0.4500
    0.0000   6.0000 8.5700    9.8600   10.7100   11.5700   12.0000   12.5700
   13.0000  13.5000
ANGLE       10.0000 4
FINH       101.6000 10
    0.0000   0.0500 0.1000    0.1500    0.2000    0.2500    0.3000    0.3500
    0.4000   0.4500
    0.0000   4.1400 7.4300   11.0000   13.4300   15.4300   17.0000   18.0000
   18.8600  19.5700
FINH       152.4000 8
    0.0000   0.0500 0.1000    0.1500    0.2000    0.2500    0.3000    0.3500
    0.0000   4.7100 9.0000   12.2900   14.1400   15.4300   16.4300   17.2900
FINH       203.2000 10
    0.0000   0.0500 0.1000    0.1500    0.2000    0.2500    0.3000    0.3500
    0.4000   0.4500
    0.0000   4.1400 7.4300    9.0000   10.0000   11.2900   12.2900   13.4300
   14.7100  16.0000
FINH       253.9999 10
    0.0000   0.0500 0.1000    0.1500    0.2000    0.2500    0.3000    0.3500
    0.4000   0.4500
    0.0000   4.7100 7.8600    9.2900   10.0000   10.7100   11.2900   12.0000
   12.4300  13.0000
ANGLE       20.0000 4
FINH       101.6000 10
    0.0000   0.0500 0.1000    0.1500    0.2000    0.2500    0.3000    0.3500
    0.4000   0.4500
    0.0000   1.4800 2.2900    2.8100    3.3300    3.7600    4.1900    4.4800

----5----0----5----0----5----0----5----0----5----0----5----0----5----0----5----0
         1         2         3         4         5         6         7         8
```

Appendix B (Continued)

```
         1         2         3         4         5         6         7         8
----5----0----5----0----5----0----5----0----5----0----5----0----5----0----5----0

    4.7400    5.0000
FINH        152.4000  10
    0.0000    0.0500  0.1000    0.1500    0.2000    0.2500    0.3000    0.3500
    0.4000    0.4500
    0.0000    1.0000  1.7100    2.2400    2.6700    3.0000    3.2900    3.4500
    3.6100    3.7600
FINH        203.2000  10
    0.0000    0.0500  0.1000    0.1500    0.2000    0.2500    0.3000    0.3500
    0.4000    0.4500
    0.0000    1.0000  1.7100    2.2400    2.5700    2.7900    3.0000    3.1400
    3.2900    3.4100
FINH        253.9999  10
    0.0000    0.0500  0.1000    0.1500    0.2000    0.2500    0.3000    0.3500
    0.4000    0.4500
    0.0000    1.2900  1.8600    2.1900    2.4800    2.6700    2.7600    2.8600
    2.9600    3.0400
ANGLE        30.0000  4
FINH        101.6000  10
    0.0000    0.0500  0.1000    0.1500    0.2000    0.2500    0.3000    0.3500
    0.4000    0.4500
    0.0000    0.5000  1.0000    1.5000    2.0000    2.4300    2.8300    3.1200
    3.3800    3.5700
FINH        152.4000  10
    0.0000    0.0500  0.1000    0.1500    0.2000    0.2500    0.3000    0.3500
    0.4000    0.4500
    0.0000    0.5000  0.8800    1.2400    1.5700    1.8800    2.1400    2.3800
    2.6000    2.7900
FINH        203.2000  10
    0.0000    0.0500  0.1000    0.1500    0.2000    0.2500    0.3000    0.3500
    0.4000    0.4500
    0.0000    0.5000  0.8300    1.1000    1.3600    1.6000    1.8200    2.0300
    2.2400    2.4300
FINH        253.9999  10
    0.0000    0.0500  0.1000    0.1500    0.2000    0.2500    0.3000    0.3500
    0.4000    0.4500
    0.0000    0.3600  0.6000    0.7900    0.9800    1.1200    1.2500    1.3800
    1.5000    1.6100
ANGLE        40.0000  4
FINH        101.6000  10
    0.0000    0.0500  0.1000    0.1500    0.2000    0.2500    0.3000    0.3500
    0.4000    0.4500
    0.0000    0.3100  0.6900    1.1400    1.5000    1.8300    2.1400    2.4800
    2.7400    2.9400
FINH        152.4000  10
    0.0000    0.0500  0.1000    0.1500    0.2000    0.2500    0.3000    0.3500
    0.4000    0.4500
    0.0000    0.2400  0.5000    0.7900    1.0500    1.2600    1.4500    1.6400
    1.7900    1.8800
FINH        203.2000  10
    0.0000    0.0500  0.1000    0.1500    0.2000    0.2500    0.3000    0.3500

----5----0----5----0----5----0----5----0----5----0----5----0----5----0----5----0
         1         2         3         4         5         6         7         8
```

Appendix B (Continued)

```
         1         2         3         4         5         6         7         8
----5----0----5----0----5----0----5----0----5----0----5----0----5----0----5----0

    0.4000    0.4500
    0.0000    0.2400  0.5000    0.7600    0.9800    1.1900    1.3800    1.5700
    1.7100    1.8300
FINH        253.9999  10
    0.0000    0.0500  0.1000    0.1500    0.2000    0.2500    0.3000    0.3500
    0.4000    0.4500
    0.0000    0.1900  0.4000    0.6000    0.7900    0.9500    1.1000    1.2400
    1.3100    1.3800
END                   0

----5----0----5----0----5----0----5----0----5----0----5----0----5----0----5----0
         1         2         3         4         5         6         7         8
```

Appendix C Graphical Output

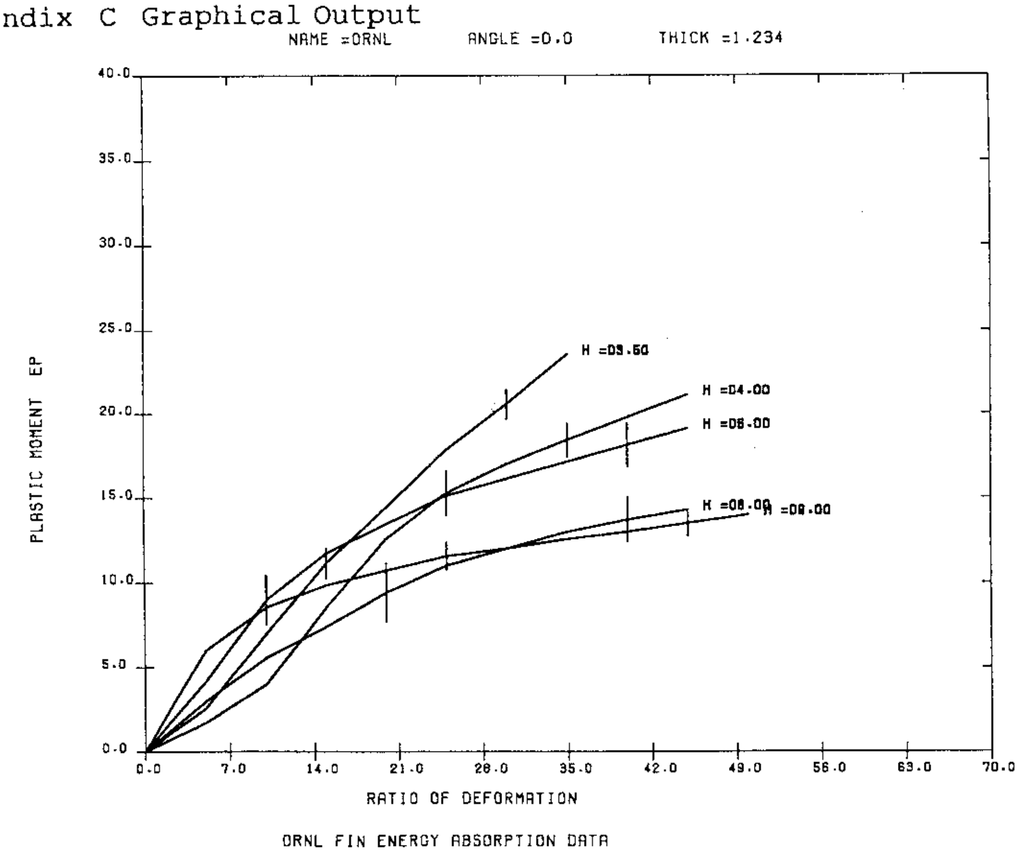

Fig. C.1 Graphical Output of FINLIB(1)

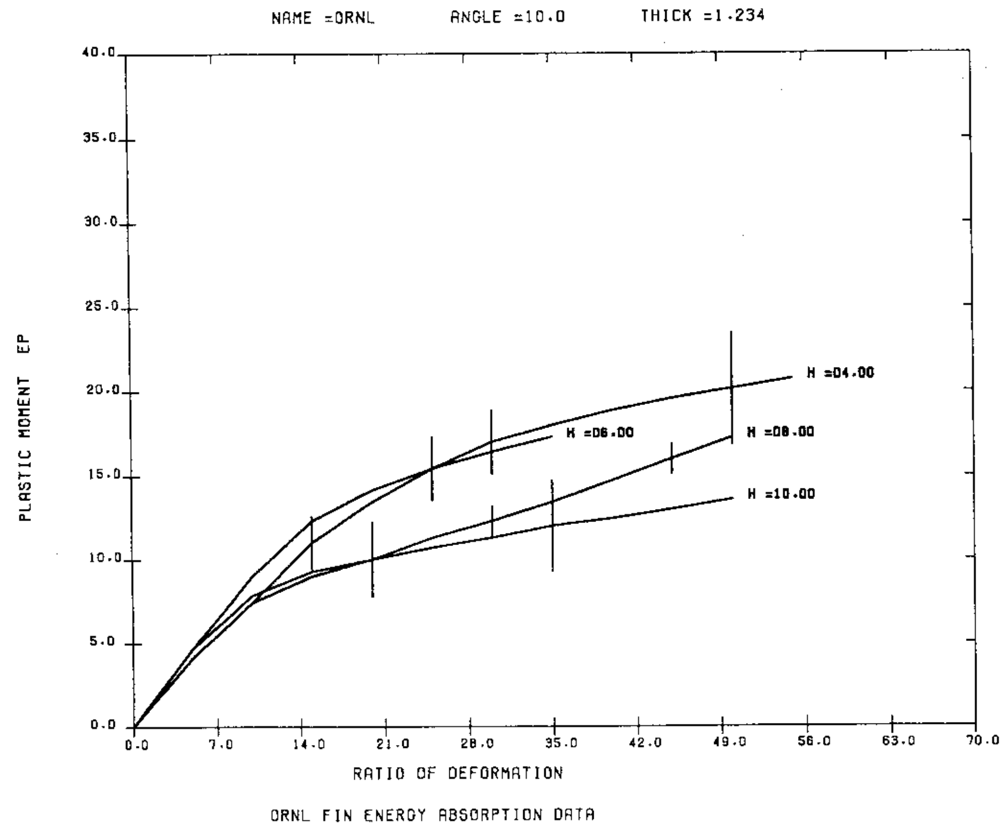

Fig. C.2 Graphical Output of FINLIB(2)

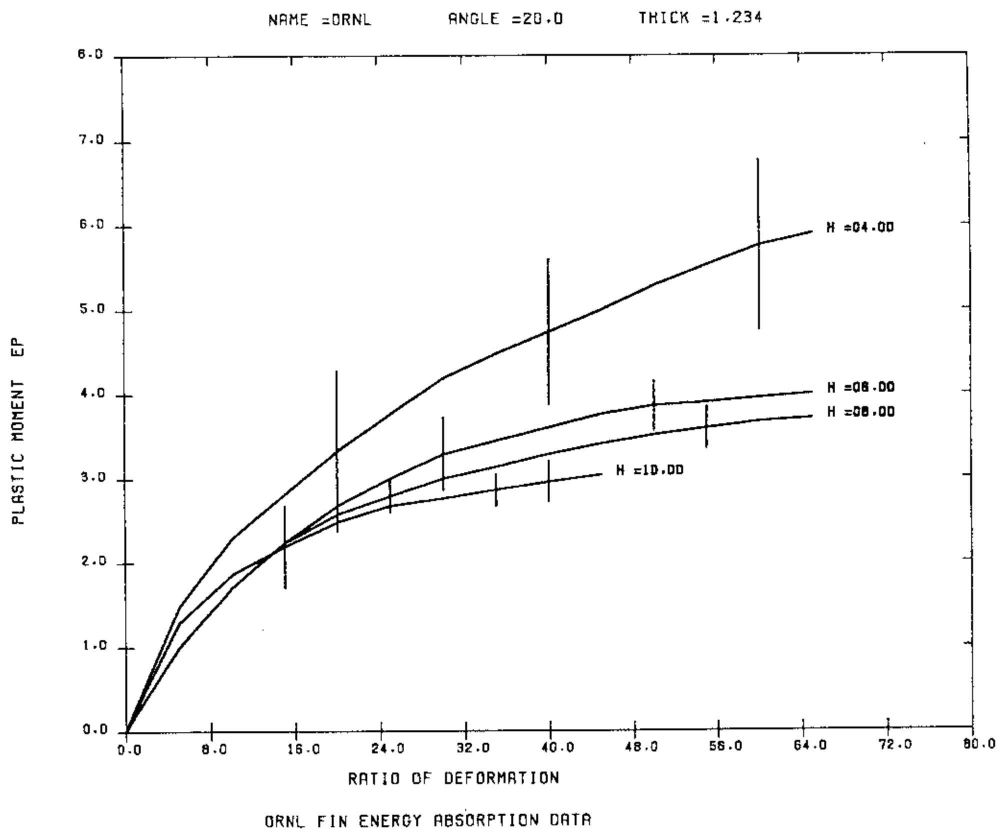

Fig. C.3 Graphical Output of FINLIB(3)

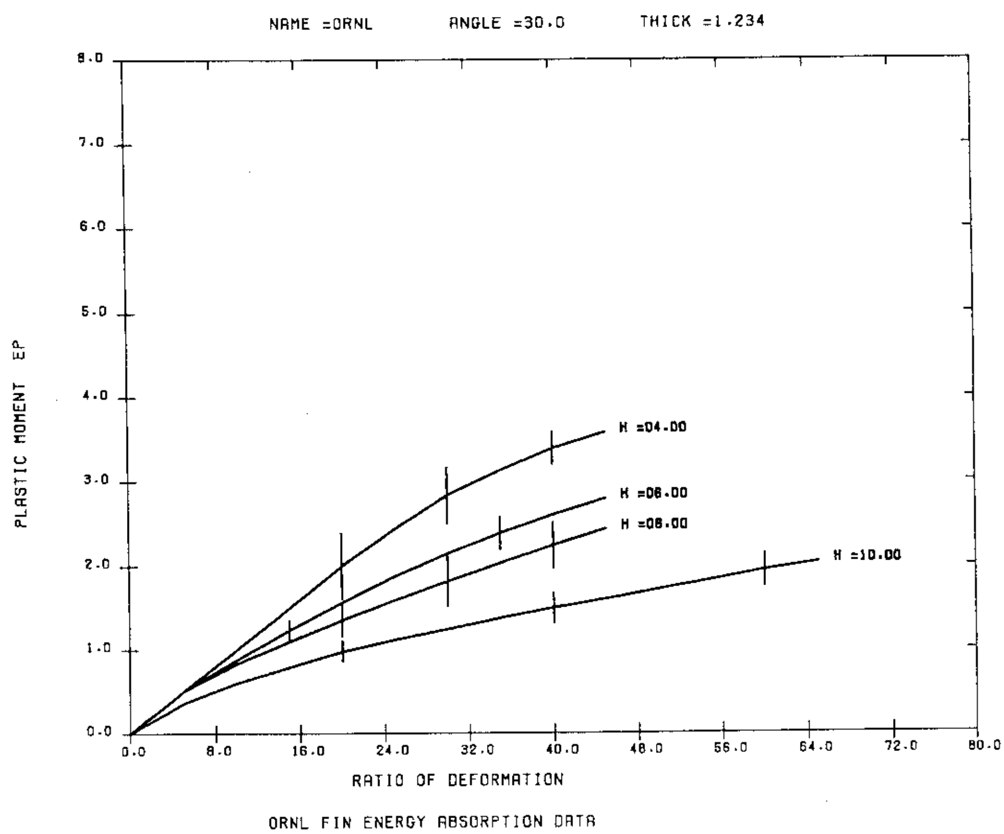

Fig. C.4 Graphical Output of FINLIB(4)

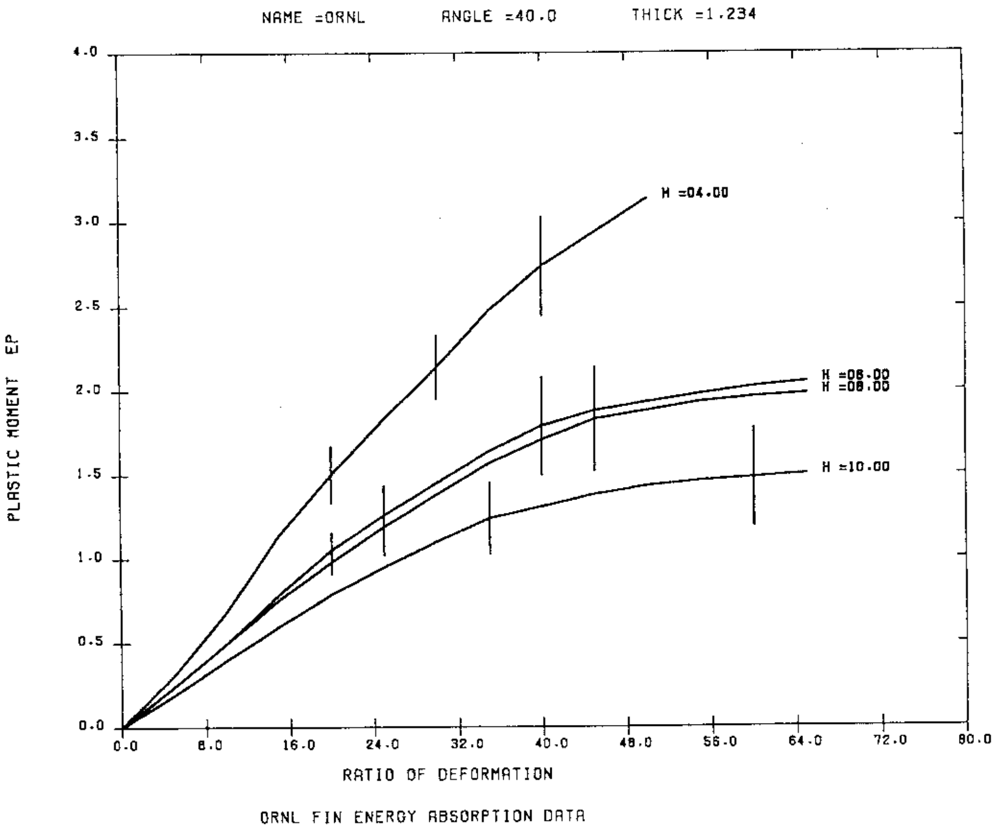

Fig. C.5 Graphical Output of FINLIB(5)

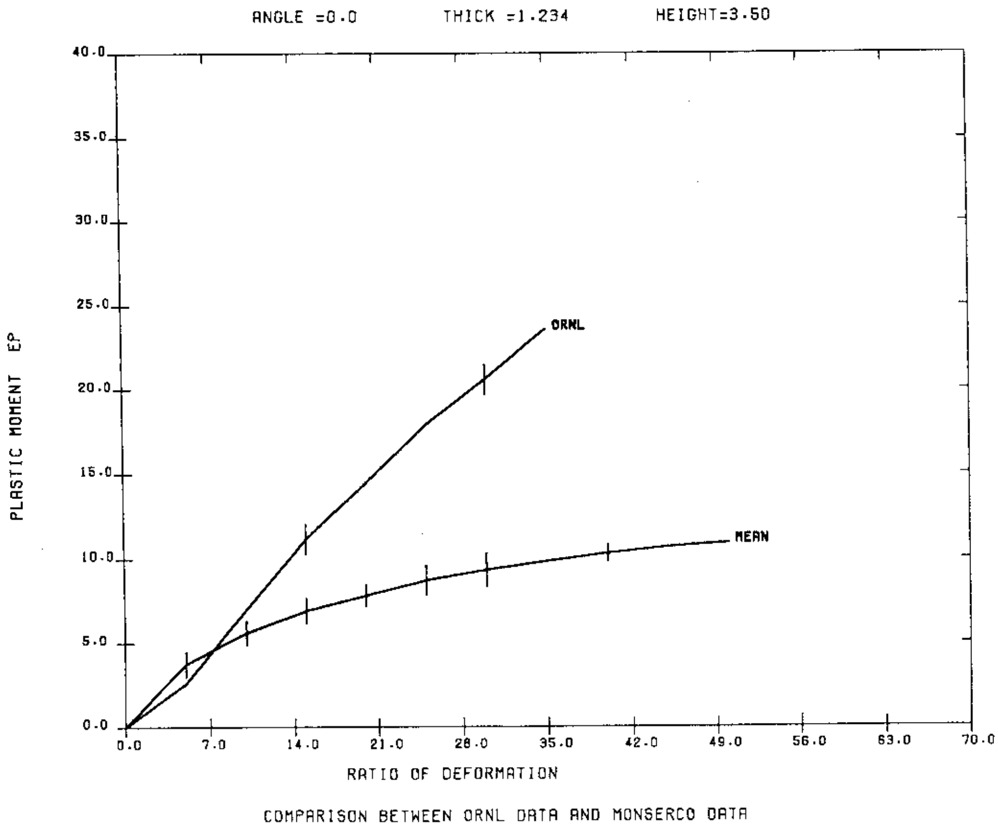

Fig. C.6 Graphical Output of FINLIB(6)

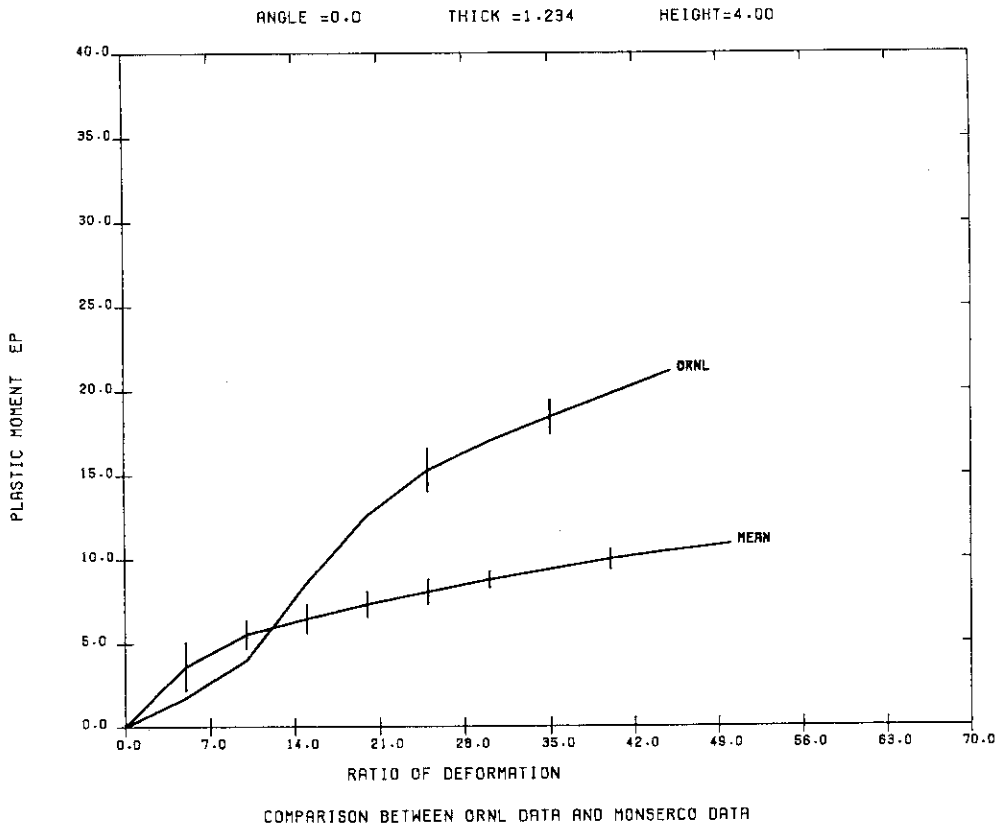

Fig. C.7 Graphical Output of FINLIB(7)

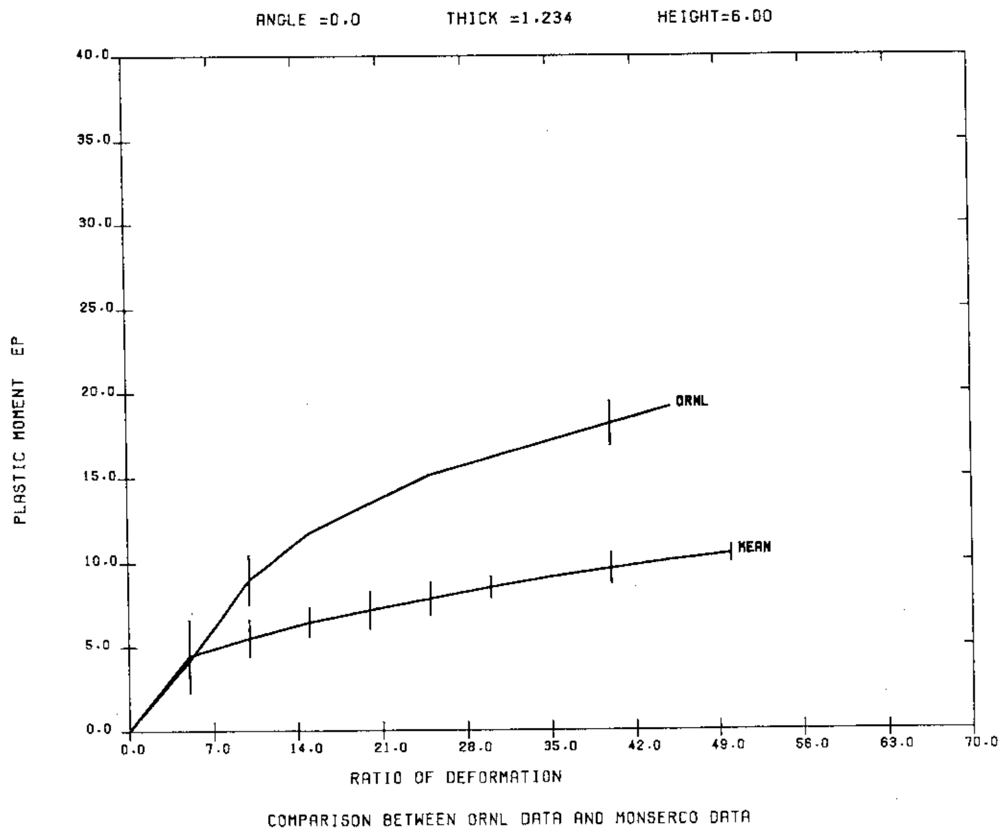

Fig. C.8 Graphical Output of FINLIB(8)

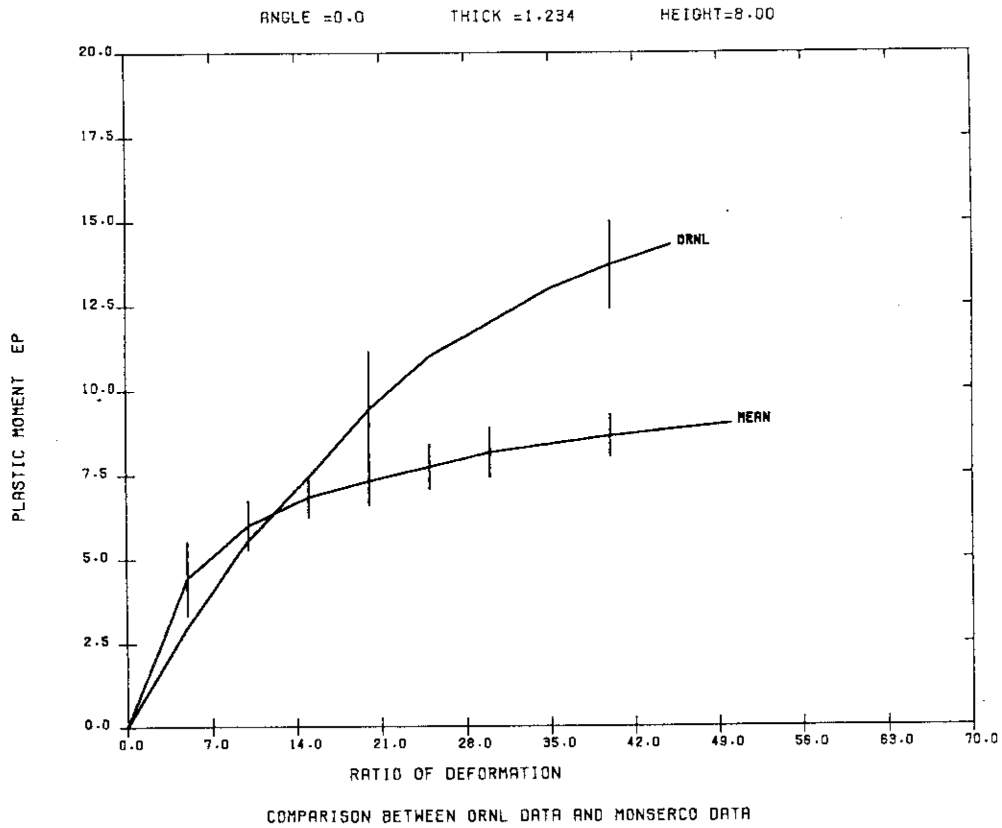

Fig. C.9 Graphical Output of FINLIB(9)

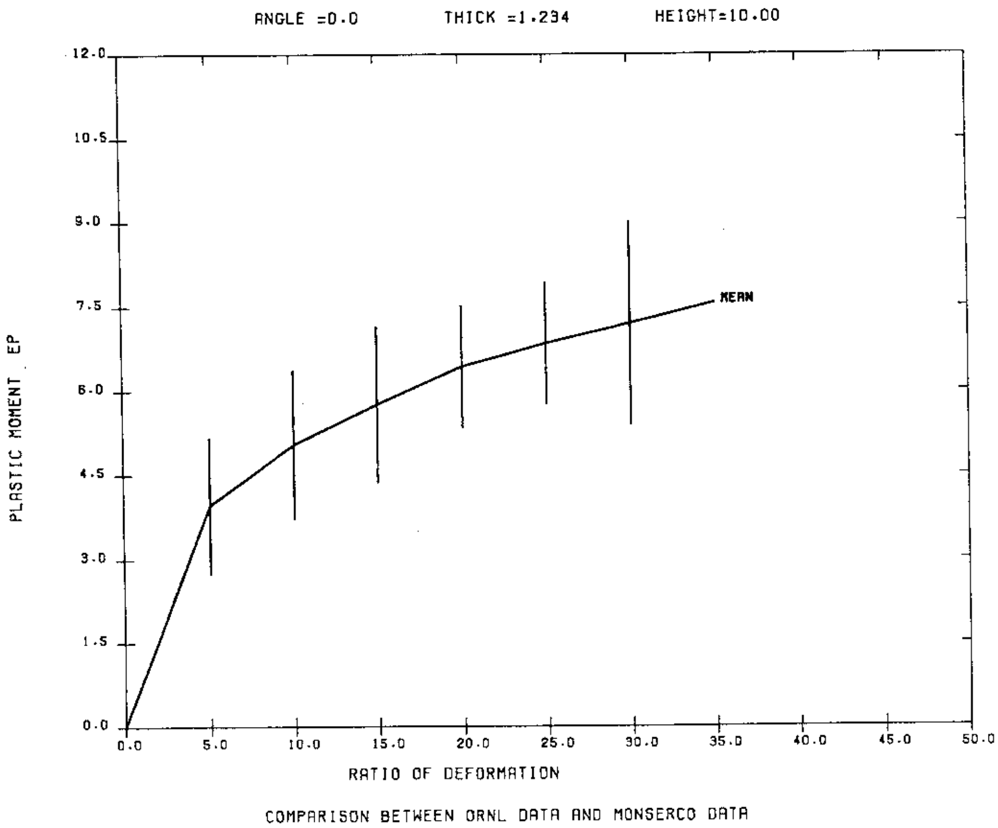

Fig. C.10 Graphical Output of FINLIB(10)

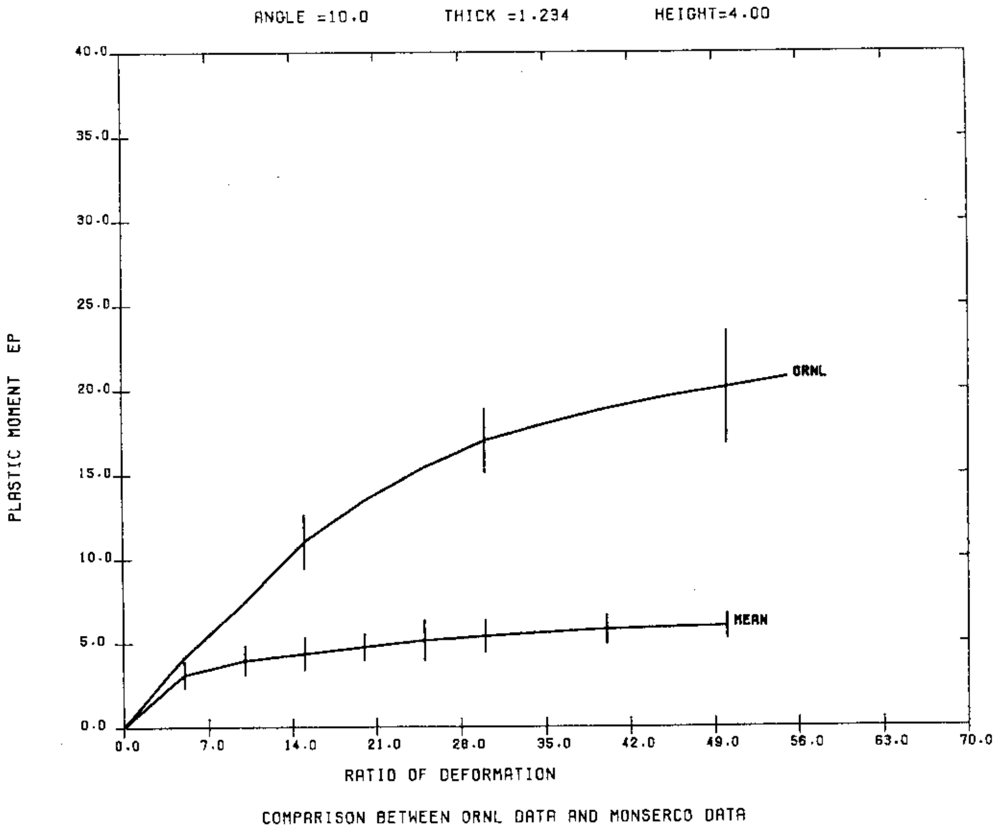

Fig. C.11 Graphical Output of FINLIB(11)

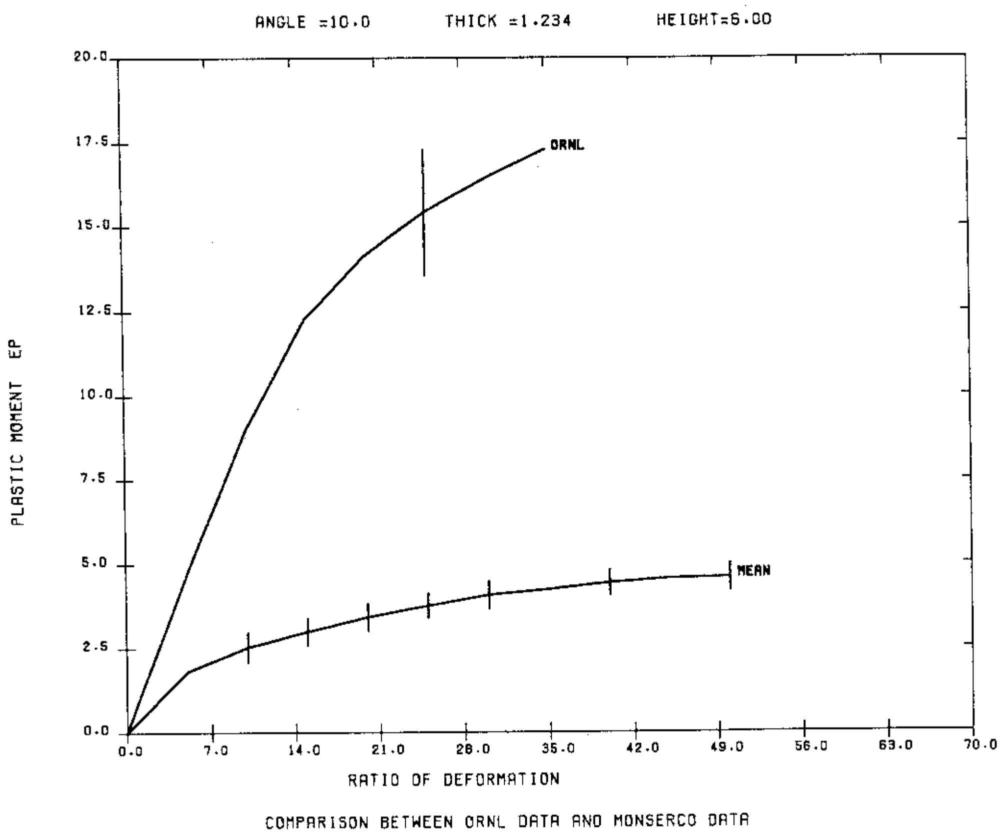

Fig. C.12 Graphical Output of FINLIB(12)

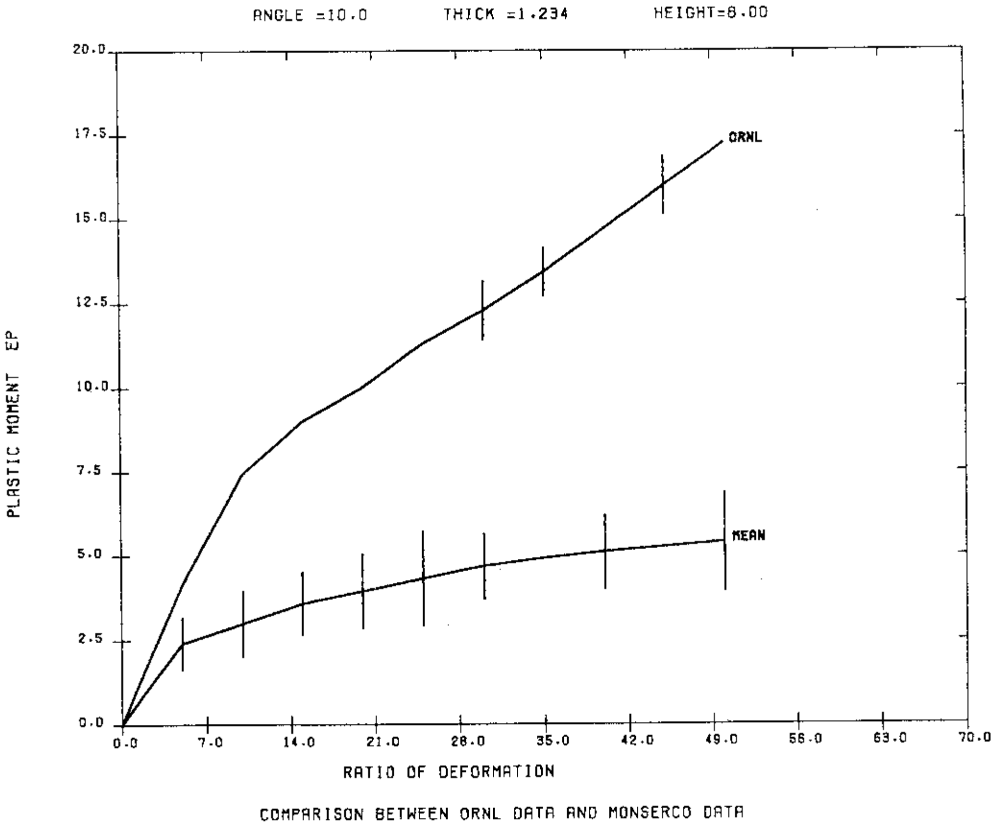

Fig. C.13 Graphical Output of FINLIB(13)

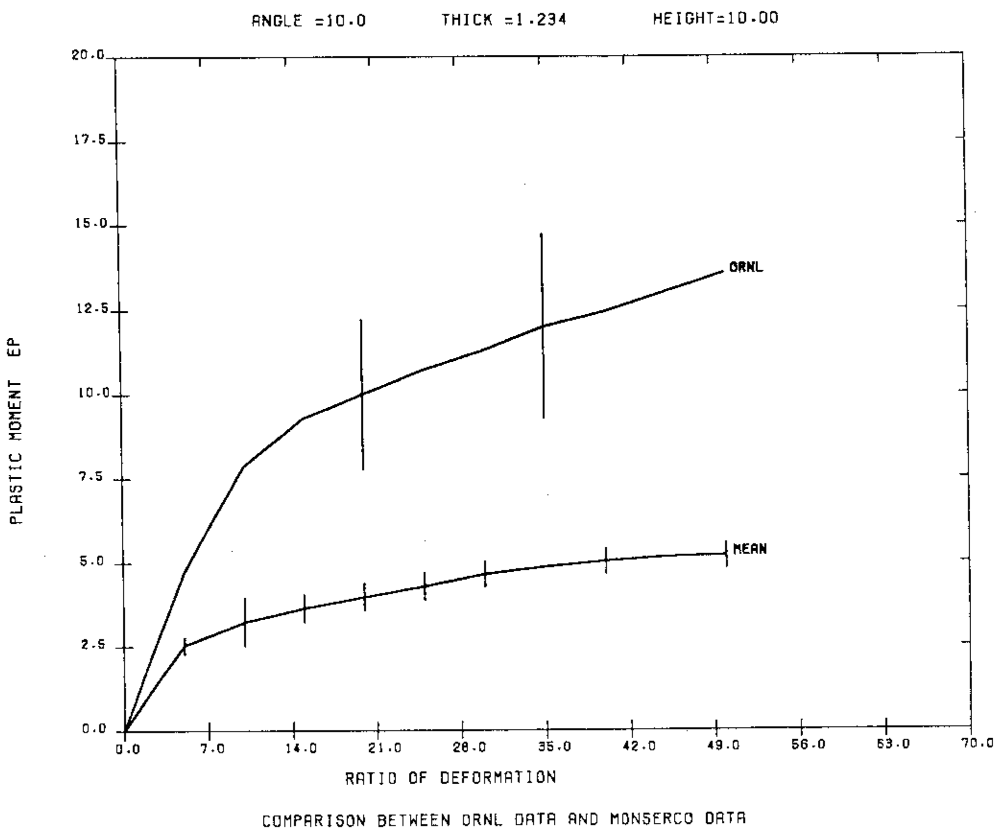

Fig. C.14 Graphical Output of FINLIB(14)

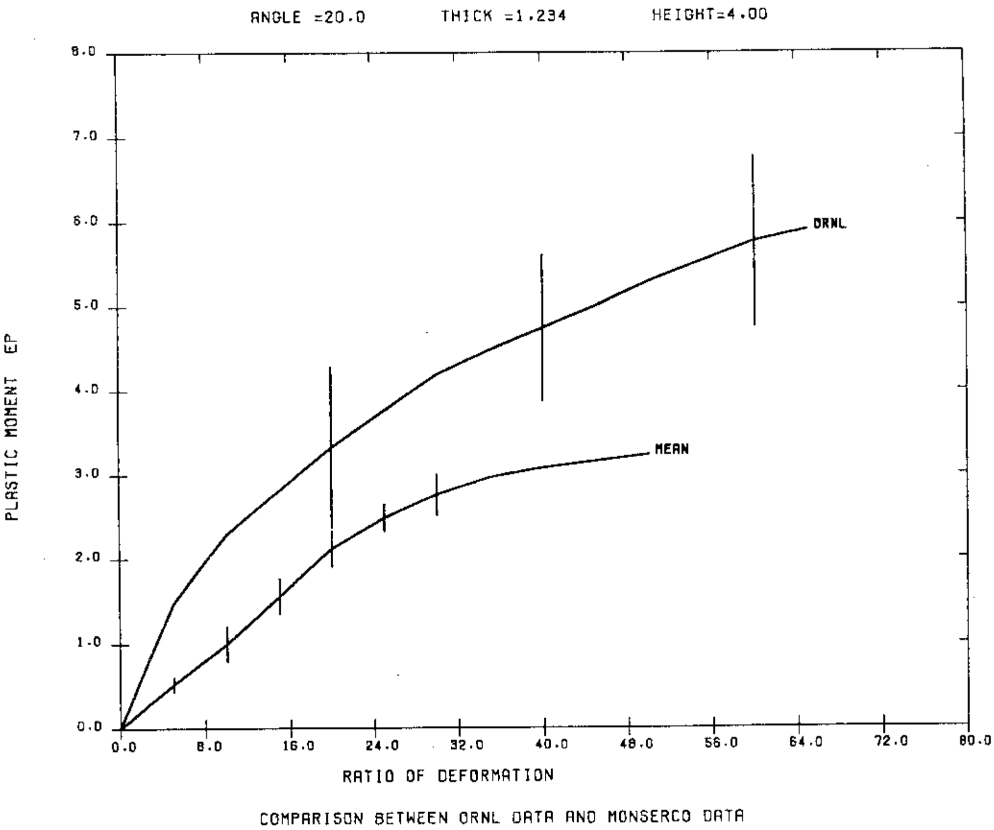

Fig. C.15 Graphical Output of FINLIB(15)

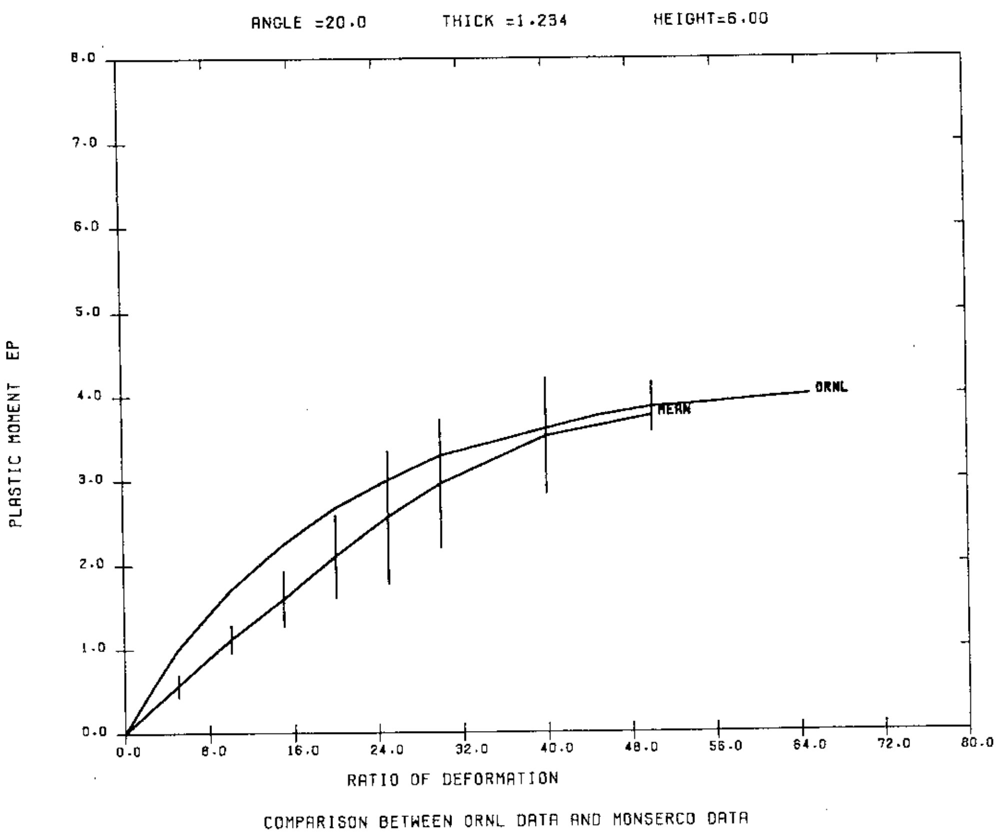

Fig. C.16 Graphical Output of FINLIB(16)

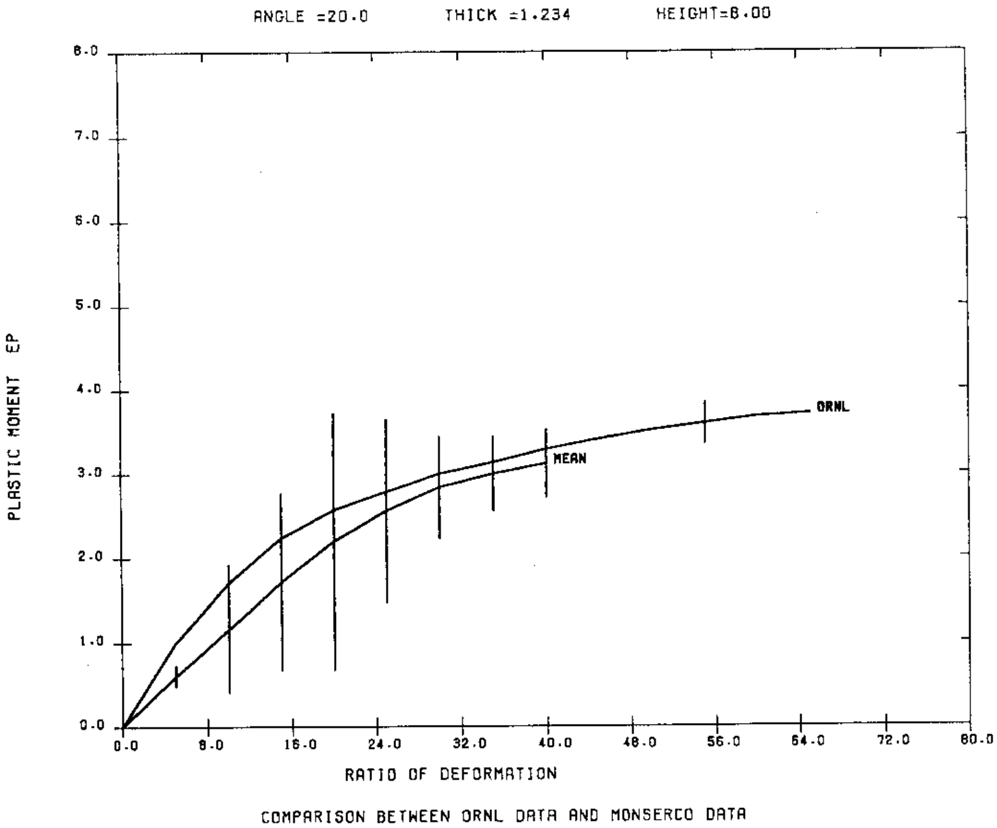

Fig. C.17 Graphical Output of FINLIB(17)

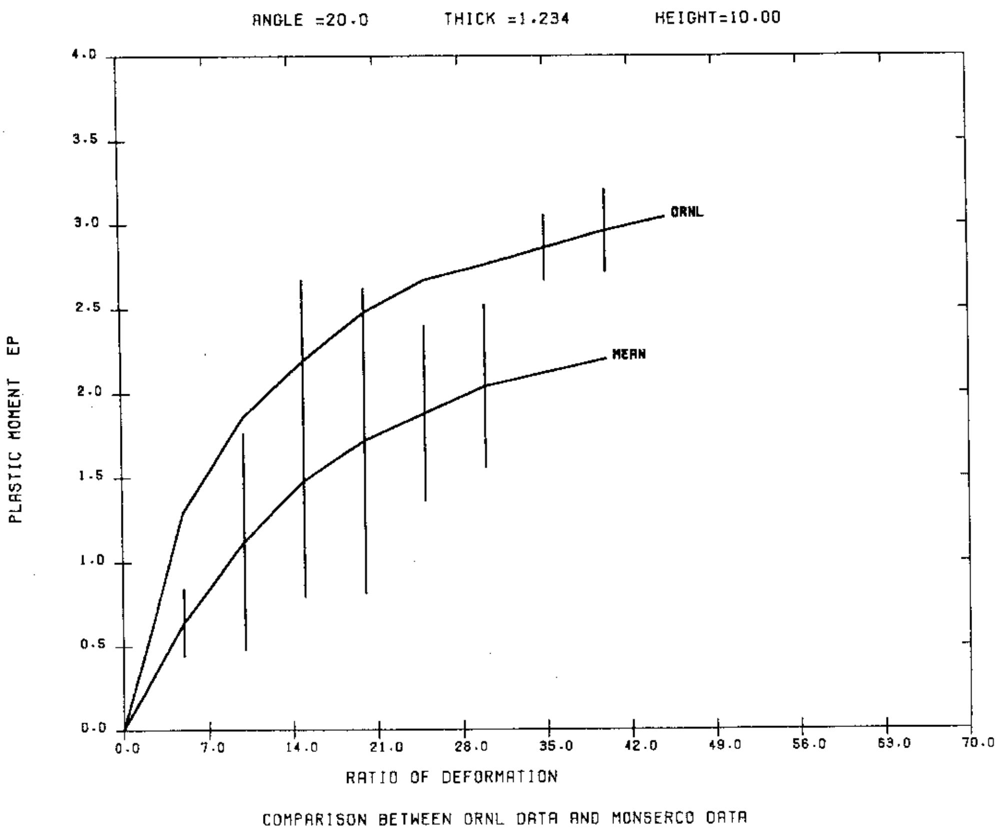

Fig. C.18 Graphical Output of FINLIB(18)

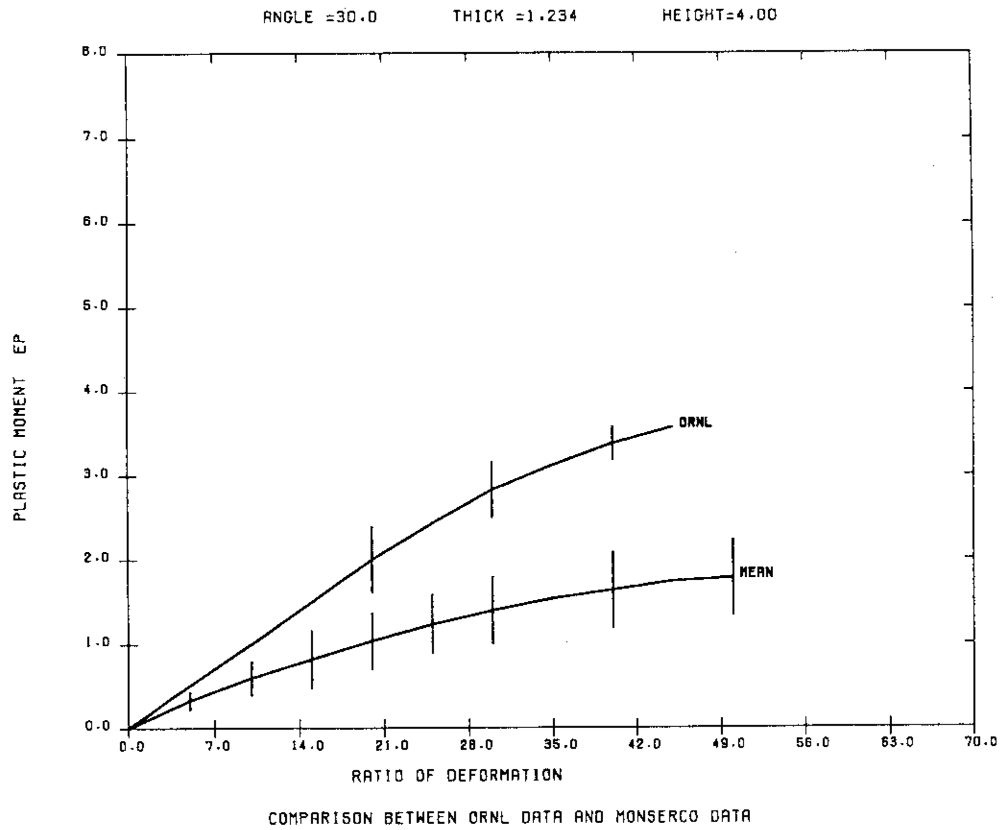

Fig. C.19 Graphical Output of FINLIB(19)

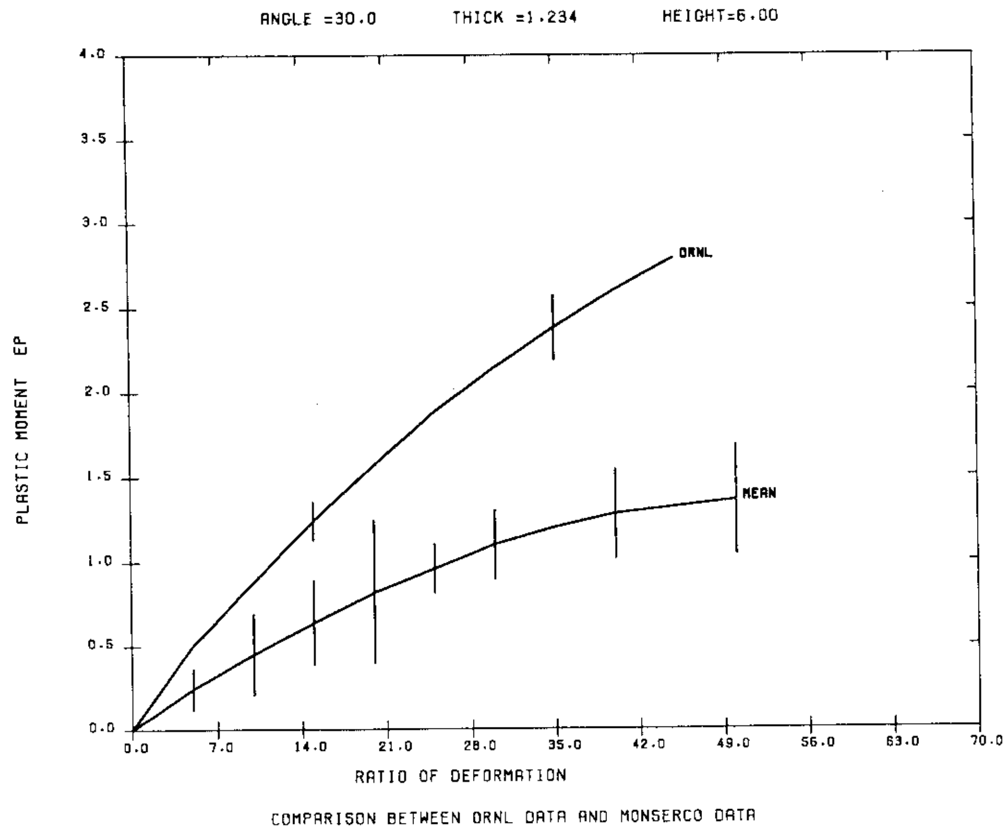

Fig. C.20 Graphical Output of FINLIB(20)

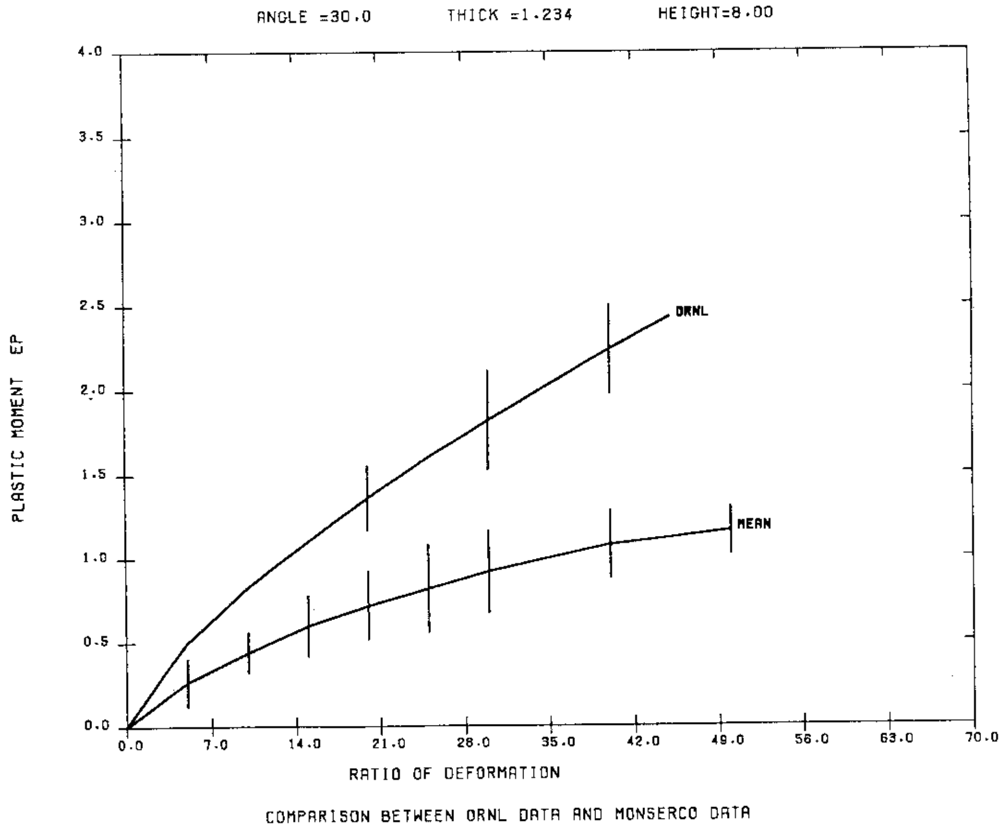

Fig. C.21 Graphical Output of FINLIB(21)

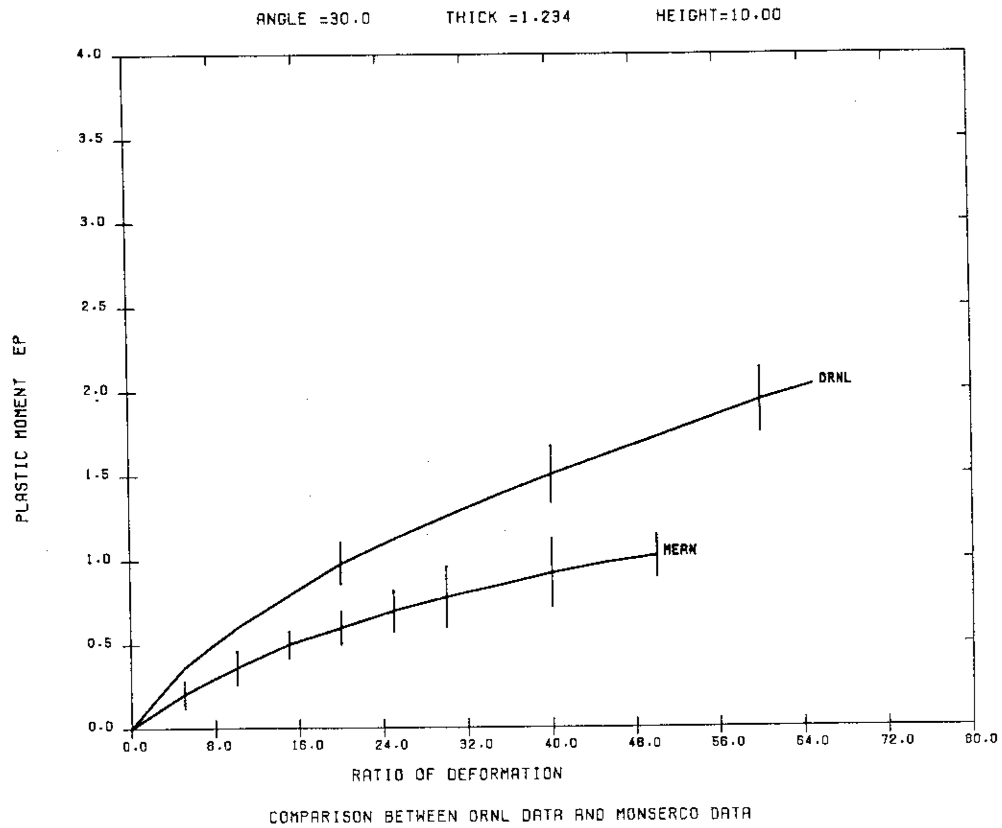

Fig. C.22 Graphical Output of FINLIB(22)

Appendix D Job Control Data

The job control data for FINLIB execution on the computer FACOM M-780 in JAERI is as follows:

```
//JCLG JOB
// EXEC JCLG
//SYSIN DD DATA,DLM='++'
// JUSER XXXXXXXX.XX,XXXXXXXX,XXXX.XX,FINLIB
// T.01 C.02 W.01 I.02 CLS GRP
// OPTP MSGCLASS=A,MSGLEVEL=(2,0,1),CLASS=B,NOTIFY=JXXXX
// OPTP PASSWORD=XXXXXXXX
// EXEC LMGOEX,LM=J2322.LMFINLIB,PNM=FINLIB
// EXPAND GRNLP
//SYSIN    DD DSN=JXXXX.DTFINLIN.DATA,DISP=SHR,LABEL=(,,,IN)
//FT01F001 DD DSN=JXXXX.DTFINDAT.DATA,DISP=SHR
//FT02F001 DD DSN=SPACE=(TRK,(5,5)),UNIT=TSSWK
//FT20F001 DD DSN=JXXXX.DTFINLIB.DATA,DISP=SHR
++
//
```

Appendix E Program Abstract

1. Name :

FINLIB.

2. Computer for which the program is designed and others upon which it is possible:

FACOM M-780, SUN4 or IBM-PC.

3. Nature of physical problem solved:

Making fin energy absorption data library used ORNL or MONSERCO experimental data.

4. Method of solutions:

-

5. Restrictions on the complexity of the problem:

None.

6. Typical running time:

FACOM-M780 : 1 seconds.
SUN4 : 2 seconds.
IBM-PC : 3 seconds.

7. Unusual features of the program:

None.

8. Related and auxiliary program:

None.

9. Status:

-

10. References:

(1)Ikushima,T. and Hode S.,"Simplified Analysis Computer Program and Their Adequacy for Radioactive Materials Shipping casks", PATRAM'89, pp.1202-1209, Washington DC, USA ,June 11-16,(1989).

(2)Ikushima,T. et al.,"Simplified Computer Codes for Cask Impact Analysis", PATRAM'92, pp.1419-1426, Yokohama, Japan, September 13-18,(1992).

(3)Ikushima,T., Ohshika,J. and Ishiwata,T.,"Computer Code System for Structural Anaalysis of Radioactive Materials Transport", PATRAM'95, pp.1174-1181, Las Vegas, USA, December 3-8,(1995).

(4)Ikushima,T.,"FINCRUSH:A Computer Program for Impact Analysis of Radioactive Material Transport Cask with Fins",JAERI-Data/Code 97-018(1997).

11.Machine requirement:

Required 1100 k bytes of core memory.

12.Program language used:

FORTRAN-77.

13.Operating system or monitor under which the program is executed:

FACOM M-780 : MSP.
SUN4 : Solaris 2.1.
IBM PC : Windows 3.1.

14.Any other programming or operating information or restrictions:

The program is approximately 1300 source steps(include comment lines). The graphical programs are as follows:

FACOM M-780 : CALCOMP plotter or the compatible ones.
SUN4 : X-windows.
IBM PC : windows 3.1.

15.Name and establishment of author:

T. Ikushima
Japan Atomic Energy Research Institute,
Tokai Research Establishment,
Department of Fuel Cycle Safety Research,
Tokai-mura, Naka-gun, Ibaraki-ken, 319-11
Japan

16.Material available:

Program source and data library.

Appendix F Program Source List

```
C.....................................................
C
C       F I N   L I B R A Y   C O D E    (1994-08-01)
C
C.....................................................
C
C***     /PROGRAMMED BY JAERI        1989.09.08
C
      IMPLICIT     REAL*8 (A-H,O-Z)
C
      COMMON /LIBRAY/ MAXREC,   LIBDAT(7,4000)
      COMMON /OPTION/ KTYPE,    KYNAME,   KYANG,    KYLENG,    KYTICK,
     +                NADD,     NLABEL(5)
      COMMON /MODEL/  MPLOT,   NTITLE(18), KEYDAT(5)
      COMMON /WORK/   LDATA(2000),        LENGTH,   NDATA
      COMMON /FINDEX/ LEVEL,    LRANGE(2,300)
C
C
C...
      KSWPLT = 0
C
C
      CALL DTLIST(55,6)
C
C... READ LIBRARY DATA
      CALL READLB
C
C
C... READ COMMAND DATA
  100 CONTINUE
      CALL GETCMD (MEOF)
      IF( MEOF.NE.0 )               GO TO 9000
C
C
C... GET PLOT DATA FROM LIBRARY
      CALL GETDAT (LDATA,LENGTH,NDATA,KEYDAT)
      IF( NDATA.EQ.0 )              GO TO 4000
C
C... SORTING DATA
      CALL SEQENT (LDATA,LENGTH,NDATA)
      IF( MPLOT.LE.0 )              GO TO 1000
C
C... PLOT DATA
      KSWPLT = KSWPLT+1
      IF( KSWPLT.EQ.1 )             CALL PLTBGN
      CALL KPLOTX (LDATA,LENGTH,NDATA)
      GO TO 100
C
C... WRITE MATERIAL DATA FOR FIN ANALYSIS
 1000 IF( MPLOT.LT.0 )              GO TO 1100
      CALL TOFIN  (LDATA,LENGTH,NDATA)
      GO TO 100
 1100 CALL TORNG  (LDATA,LENGTH,NDATA)
      GO TO 100
C
C***
 4000 WRITE(6,4010)
 4010 FORMAT(1X,13H** ERROR **  ,10X,21HEMPTY DATA IN BUFFER. )
```

Appendix F (Continued)

```
      GO TO 100
C
C
C...
 9000 CONTINUE
      IF( KSWPLT.GT.0 )              CALL PLTEND
      STOP
      END


      SUBROUTINE    READLB
C
C****   /PURPOSE/
C         READ LIBRARY DATA FROM UNIT NO.1
C
C***     PROGRAMMED BY JAERI        1989.09.08
C
C
      IMPLICIT      REAL*8 (A-H,O-Z)
C
      COMMON /LIBRAY/ MAXREC,    LIBDAT(7,4000)
      DIMENSION           NBUFF(7)
      DATA MT/    1  /
      DATA NBLANK/ 4H      /
      DATA NCOMMT/ 4H:     /
C
C
C.....
      REWIND MT
      MAXREC = 0
      DO 10 I=1,7
   10 NBUFF(I) =NBLANK
C
C
  100 READ(MT,200,END=900)      NBUFF
  200 FORMAT(A4,2A2,4A4)
      IF( NBUFF(1).EQ.NCOMMT )            GO TO 100
C
      MAXREC = MAXREC+1
      DO 300 I=1,7
  300 LIBDAT(I,MAXREC) = NBUFF(I)
CRC
C     WRITE(6,1)                NBUFF
C   1 FORMAT(1X,A4,1X,2A4,1X,A4,1X,A4,1X,A4,1X,A4)
      GO TO 100
C
C
  900 CONTINUE
      WRITE(6,990)              MAXREC
  990 FORMAT(1X,4HREAD,I6,20H CARDS FROM LIBRARY.)
      RETURN
      END
```

Appendix F (Continued)

```
      SUBROUTINE    GETDAT (LDATA,LENGTH,NDATA,KEYDAT)
C
C****   /PURPOSE/
C         GET DATA FROM LIBRARY DATA
C
C***    /OUTPUT/
C         LDATA     : SELECTED DATA
C         NDATA     : NO. OF RECORDS
C
C***    /INPUT/
C         LENGTH    : RECORD LENGTH
C         KEYDAT    : POSITION OF KEY
C
C***     PROGRAMMED BY JAERI        1989.09.08
C
C
      IMPLICIT      REAL*8 (A-H,O-Z)
C
      COMMON /LIBRAY/ MAXREC,    LIBDAT(7,4000)
      COMMON /OPTION/ KTYPE,     KYNAME,   KYANG,    KYLENG,   KYTICK,
     +                NADD,      NLABEL(5)
      COMMON /RVALUE/ ANGLE,     HEIGHT,   THICK,    KNAME
C
      DIMENSION       LDATA(LENGTH,1), KEYDAT(1)
      DIMENSION       VALUE(6), INTVAL(2)
      EQUIVALENCE    (VALUE(6),INTVAL(1))
      CHARACTER*40    FILE
C
      DATA JJORNL/ 4HORNL /
      DATA NBLANK/ 4H     /
C
C
C....
      NDATA   = 0
      KEY     = LENGTH-2
      MKEY    = KEY-1
C
      IF( KTYPE.GT.0 )                GO TO 1000
C
C
      DO 500 II=1,MAXREC
C.. (NAME) KEY
      IF( KYNAME.EQ.NBLANK )          GO TO 100
      IF( KYNAME.NE.LIBDAT(1,II) )    GO TO 500
C.. (ANGLE) KEY
  100 IF( KYANG .EQ.NBLANK )          GO TO 200
      IF( KYANG .NE.LIBDAT(2,II) )    GO TO 500
C.. (LENGTH) KEY
  200 IF( KYLENG.EQ.NBLANK )          GO TO 300
      IF( KYLENG.NE.LIBDAT(4,II) )    GO TO 500
C.. (THICK) KEY
  300 IF( KYTICK.EQ.NBLANK )          GO TO 400
      IF( KYTICK.NE.LIBDAT(5,II) )    GO TO 500
C
C....
  400 CONTINUE
      WRITE(FILE,10)           (LIBDAT(I,II),I=1,7)
      READ (FILE,20)           NAME, VALUE
```

Appendix F (Continued)

```
   10 FORMAT(A4,A2,2H.0,A2,2H.0,4A4)
   20 FORMAT(A4,2F4.1,F4.2,F4.3,2F4.2)
      KNAME  = NAME
      ANGLE  = VALUE(1)
      HEIGHT = VALUE(3)
      THICK  = VALUE(4)
C
      NDATA  = NDATA+1
      LDATA(KEY  ,NDATA) = LIBDAT(3,II)
      LDATA(KEY+1,NDATA) = LIBDAT(6,II)
      LDATA(KEY+2,NDATA) = LIBDAT(7,II)
C
      DO 450 JK=1,MKEY
      K      = KEYDAT(JK)
      LDATA(JK,NDATA) = LIBDAT(K,II)
  450 CONTINUE
C
  500 CONTINUE
      RETURN
C
C
C..
 1000 CONTINUE
      IF( KTYPE.NE.1 )                GO TO 2000
      DO 1500 II=1,MAXREC
C..
      IF( JJORNL.EQ.LIBDAT(1,II) ) GO TO 1500
C.. (ANGLE) KEY
      IF( KYANG .EQ.NBLANK )          GO TO 1200
      IF( KYANG .NE.LIBDAT(2,II) ) GO TO 1500
C.. (LENGTH) KEY
 1200 IF( KYLENG.EQ.NBLANK )          GO TO 1300
      IF( KYLENG.NE.LIBDAT(4,II) ) GO TO 1500
C.. (THICK) KEY
 1300 IF( KYTICK.EQ.NBLANK )          GO TO 1400
      IF( KYTICK.NE.LIBDAT(5,II) ) GO TO 1500
C
C....
 1400 CONTINUE
      WRITE(FILE,10)          (LIBDAT(I,II),I=1,7)
      READ (FILE,20)          NAME, VALUE
      KNAME  = NAME
      ANGLE  = VALUE(1)
      HEIGHT = VALUE(3)
      THICK  = VALUE(4)
C
      NDATA  = NDATA+1
      LDATA(KEY  ,NDATA) = LIBDAT(3,II)
      LDATA(KEY+1,NDATA) = LIBDAT(6,II)
      LDATA(KEY+2,NDATA) = LIBDAT(7,II)
C
      DO 1450 JK=1,MKEY
      K      = KEYDAT(JK)
      LDATA(JK,NDATA) = LIBDAT(K,II)
 1450 CONTINUE
C
 1500 CONTINUE
      RETURN
```


Appendix F (Continued)

```
C
C
C..
 2000 CONTINUE
      DO 2500 II=1,MAXREC
C.. (NAME) KEY
      DO 2010 I=1,NADD
      NAME   = NLABEL(I)
      IF( NAME  .EQ.LIBDAT(1,II) ) GO TO 2100
 2010 CONTINUE
      GO TO 2500
C.. (ANGLE) KEY
 2100 IF( KYANG .EQ.NBLANK )          GO TO 2200
      IF( KYANG .NE.LIBDAT(2,II) ) GO TO 2500
C.. (LENGTH) KEY
 2200 IF( KYLENG.EQ.NBLANK )          GO TO 2300
      IF( KYLENG.NE.LIBDAT(4,II) ) GO TO 2500
C.. (THICK) KEY
 2300 IF( KYTICK.EQ.NBLANK )          GO TO 2400
      IF( KYTICK.NE.LIBDAT(5,II) ) GO TO 2500
C
C....
 2400 CONTINUE
      WRITE(FILE,10)          (LIBDAT(I,II),I=1,7)
      READ (FILE,20)          NAME, VALUE
      KNAME  = NAME
      ANGLE  = VALUE(1)
      HEIGHT = VALUE(3)
      THICK  = VALUE(4)
C
      NDATA  = NDATA+1
      LDATA(KEY  ,NDATA) = LIBDAT(3,II)
      LDATA(KEY+1,NDATA) = LIBDAT(6,II)
      LDATA(KEY+2,NDATA) = LIBDAT(7,II)
C
      DO 2450 JK=1,MKEY
      K      = KEYDAT(JK)
      LDATA(JK,NDATA) = LIBDAT(K,II)
 2450 CONTINUE
C
 2500 CONTINUE
      RETURN
      END


      SUBROUTINE    GETCMD (MEOF)
C
C****    /PURPOSE/
C          GET PLOT DATA
C
C***     /OUTPUT/
C          MEOF       : SWITCH OF EXECUTION
C
C***      PROGRAMMED BY JAERI        1989.09.11
C
C
      IMPLICIT     REAL*8 (A-H,O-Z)
```

Appendix F (Continued)

```
C
C
      COMMON /OPTION/ KTYPE,    KYNAME,   KYANG,    KYLENG,   KYTICK,
     +                NADD,     NLABEL(5)
      COMMON /MODEL/  MPLOT,    NTITLE(18), KEYDAT(5)
      COMMON /WORK/   LDATA(2000),        LENGTH,   NDATA
C
      DIMENSION       M1CMD(7), M2CMD(4), M2LNG(2,3), MONSER(8)
      DIMENSION       MMORNL(3)
      CHARACTER       BUFF*80, SBUFF*80, LBUFF*4, CLEAR1*4, CLEAR2*4
      CHARACTER       CMD1(7)*5, CMD2(4)*7, NUMB(10)*1
      CHARACTER       BLANK*1, POINT*1
C
      DATA M1CMD/    5,   3,   3,   4,   3,   5,   5 /
      DATA M2CMD/    5,   6,   7,   6 /
      DATA M2LNG/    2, 0,   2, 2,   1, 3 /
      DATA NBLANK/  4H    /
      DATA MONSER/  4HMWID, 4HMPAR, 4HMCON, 4HMBRA, 4HMOAK,
     +              4HMEAN, 4HMHIG, 4HMLOW/
      DATA MMORNL/  4HORNL, 4HOHIG, 4HOLOW/
      DATA JJORNL/  4HORNL /
      DATA KDEFTT/  4H1234 /
C
      DATA CLEAR1,CLEAR2/  '0000', '00  ' /
      DATA POINT,BLANK/    '.', ' ' /
      DATA CMD1/  'TITLE',  'KEY  ',  'ADD  ',  'PLOT ',  'END  ',
     +            'WRITE',  'RANGE'/
      DATA CMD2/  'NAME=  ',  'ANGLE= ',  'LENGTH=',  'THICK= ' /
      DATA NUMB/  '0', '1', '2', '3', '4', '5', '6', '7', '8', '9' /
C
C
C...
      MEOF   = 0
      LYNAME = JJORNL
C
C
C... READ A COMMAND
  100 WRITE(6,110)
  110 FORMAT(5H CMD>)
      READ(55,150)            BUFF
  150 FORMAT(A80)
CRC
C     WRITE(6,1)        BUFF
C   1 FORMAT(1X,A80)
C
      DO 200 IC=1,7
      LENG   = M1CMD(IC)
      DO 180 I=1,LENG
      IF( BUFF(I:I).NE.CMD1(IC)(I:I) )  GO TO 200
  180 CONTINUE
      GO TO 300
  200 CONTINUE
      WRITE(6,250)            CMD1
  250 FORMAT(1X,20H**UNDEFINED COMMAND. /1X,11HCOMMANDS =>,7A8)
      GO TO 100
C
  300 IP     = LENG+1
      GO TO ( 310, 400, 510, 610, 710, 810, 910 )    , IC
```

Appendix F (Continued)

```
C
C. (TITLE)
  310 L      = 81-IP
      SBUFF(1:L) = BUFF(IP:80)
  350 L      = L+1
      IF( L.GT.80 )                           GO TO 360
      SBUFF(L:L) = BLANK
      GO TO 350
  360 READ(SBUFF,370)         NTITLE
  370 FORMAT(18A4)
      GO TO 100
C
C. (KEY)
  400 KYNAME = NBLANK
      KYANG  = NBLANK
      KYLENG = NBLANK
      KYTICK = NBLANK
C
  410 IP     = IP+1
      IF( IP.GT.80 )                          GO TO 100
      IF( BUFF(IP:IP).EQ.BLANK )              GO TO 410
      LS     = IP-1
      DO 430 IY=1,4
      LENG   = M2CMD(IY)
      DO 420 I=1,LENG
      J      = LS+I
      IF( BUFF(J:J).NE.CMD2(IY)(I:I) )  GO TO 430
  420 CONTINUE
      GO TO 450
  430 CONTINUE
      WRITE(6,435)
  435 FORMAT(1X,22H**UNDEFINED PARAMETER. )
      GO TO 100
  440 WRITE(6,445)
  445 FORMAT(1X,11HERROR DATA. )
      GO TO 100
C..
  450 IP     = IP+LENG
      IF( IY.NE.1 )                           GO TO 460
      IX     = IP+3
      LBUFF  = BUFF(IP:IX)
      READ(LBUFF,455)            NAME
  455 FORMAT(A4)
C
      KYNAME = NAME
      IP     = IX
      GO TO 410
C..
  460 IY     = IY-1
      L1     = 0
      L2     = 0
  461 IF( BUFF(IP:IP).EQ.BLANK )              GO TO 470
      IF( BUFF(IP:IP).EQ.POINT )              GO TO 462
      L1     = L1+1
      SBUFF(L1:L1) = BUFF(IP:IP)
      IP     = IP+1
      IF( IP.LE.80 )                          GO TO 461
      GO TO 470
```

Appendix F (Continued)

```
  462 IP      = IP+1
      IF( IP.GT.80 )                      GO TO 470
      IF( BUFF(IP:IP).EQ.BLANK )          GO TO 470
      L2      = L2+1
      SBUFF(L2+10:L2+10) = BUFF(IP:IP)
      GO TO 462
C
  470 IF( L1.GT.M2LNG(1,IY) )             GO TO 440
      IF( L2.GT.M2LNG(2,IY) )             L2      = M2LNG(2,IY)
      IF( IY.NE.1 )             LBUFF  = CLEAR1
      IF( IY.EQ.1 )             LBUFF  = CLEAR2
C
      LENG    = M2LNG(1,IY)
      IF( L1.EQ.0 )                       GO TO 475
      IF( L1.LT.LENG )                    GO TO 472
      DO 471 I=1,LENG
  471 LBUFF(I:I) = SBUFF(I:I)
      GO TO 475
  472 LL      = LENG-L1+1
      J       = 0
      DO 473 I=LL,LENG
      J       = J+1
  473 LBUFF(I:I) =SBUFF(J:J)
C
  475 IF( IY.EQ.1 )                       GO TO 480
      IF( L2.EQ.0 )                       GO TO 480
      J       = LENG
      DO 476 I=1,L2
      J       = J+1
  476 LBUFF(J:J) =SBUFF(I+10:I+10)
C
  480 READ(LBUFF,455)              NAME
      J2      = 4
      IF( IY.EQ.1 )                       J2      = 2
      DO 485 J=1,J2
      DO 484 I=1,10
      IF( LBUFF(J:J).EQ.NUMB(I) )         GO TO 485
  484 CONTINUE
      GO TO 440
  485 CONTINUE
C
      GO TO ( 491, 492, 493 )  , IY
  491 KYANG  = NAME
      GO TO 410
  492 KYLENG = NAME
      GO TO 410
  493 KYTICK = NAME
      GO TO 410
C
C. (ADD)
  510 NADD    = 0
  520 IP      = IP+1
      IF( IP.GT.80 )                      GO TO 100
      IF( BUFF(IP:IP).EQ.BLANK )          GO TO 520
      IX      = IP+3
      LBUFF   = BUFF(IP:IX)
      READ(LBUFF,455)              NAME
C
```

Appendix F (Continued)

```
      IP      = IX
      NADD    = NADD+1
      IF( NADD.GT.5 )                     GO TO 100
      NLABEL(NADD) = NAME
      DO 530 I=1,8
      IF( NLABEL(NADD).EQ.MONSER(I) )     GO TO 520
  530 CONTINUE
      DO 535 I=1,3
      IF( NLABEL(NADD).EQ.MMORNL(I) )     GO TO 520
  535 CONTINUE
      WRITE(6,540)                 NLABEL(NADD)
  540 FORMAT(1X,31H**UNDEFINED PARAMETER.   NAME= ,A4)
      GO TO 100
C
C. (PLOT)
  610 IP      = IP+1
      IF( IP.GT.80 )                      GO TO 100
      IF( BUFF(IP:IP).EQ.BLANK )          GO TO 610
      DO 620 MPLOT=1,6
      IF( BUFF(IP:IP).EQ.NUMB(MPLOT+1) )GO TO 2000
  620 CONTINUE
      WRITE(6,630)            BUFF(IP:IP)
  630 FORMAT(1X,24HERROR PLOT CODE.   CODE=,A1)
      GO TO 100
C
C. (END)
  710 CONTINUE
      MEOF    = 1
      RETURN
C
C. (WRITE)
  810 IP      = IP+1
      IF( IP.GT.80 )                      GO TO 100
      IF( BUFF(IP:IP).EQ.BLANK )          GO TO 810
      IX      = IP+3
      LBUFF   = BUFF(IP:IX)
      READ(LBUFF,455)              NAME
C
      DO 820 I=1,8
      IF( NAME.EQ.MONSER(I) )             GO TO 850
  820 CONTINUE
      DO 825 I=1,3
      IF( NAME.EQ.MMORNL(I) )             GO TO 850
  825 CONTINUE
      WRITE(6,540)                 NAME
      GO TO 100
C
  850 CONTINUE
      MPLOT   = 0
      GO TO 2900
C
C. (RANGE)
  910 IP      = IP+1
      IF( IP.GT.80 )                      GO TO 100
      IF( BUFF(IP:IP).EQ.BLANK )          GO TO 910
      IX      = IP+3
      LBUFF   = BUFF(IP:IX)
      READ(LBUFF,455)              NAME
```

Appendix F (Continued)

```
C
      DO 920 I=1,8
      IF( NAME.EQ.MONSER(I) )           GO TO 950
  920 CONTINUE
      DO 925 I=1,3
      IF( NAME.EQ.MMORNL(I) )           GO TO 950
  925 CONTINUE
      WRITE(6,540)                   NAME
      WRITE(6,930)                   MONSER, MMORNL
  930 FORMAT(1X,14HLIBRARY NAME=>,9A6/15X,9A6)
      GO TO 100
C
  950 CONTINUE
      MPLOT  = -1
      GO TO 2900
C
C
C
C...  END OF INPUT
 2000 CONTINUE
C
      GO TO ( 2100, 2200, 2300, 2400, 2500, 2600 )        , MPLOT
C
C. (A-TYPE PLOT)
 2100 IF( KYNAME.EQ.NBLANK )            GO TO 2910
      IF( KYANG .EQ.NBLANK )            GO TO 2920
      IF( KYTICK.EQ.NBLANK )            KYTICK = KDEFTT
C
      KYLENG = NBLANK
      LENGTH = 4
      KEYDAT(1) = 4
      KTYPE  = 0
      GO TO 3000
C
C. (B-TYPE PLOT)
 2200 IF( KYANG .EQ.NBLANK )            GO TO 2920
      IF( KYLENG.EQ.NBLANK )            GO TO 2930
      IF( KYTICK.EQ.NBLANK )            KYTICK = KDEFTT
C
      KYNAME = NBLANK
      LENGTH = 4
      KEYDAT(1) = 1
      KTYPE  = 1
      GO TO 3000
C
C. (C-TYPE PLOT)
 2300 IF( KYNAME.EQ.NBLANK )            GO TO 2910
      IF( KYLENG.EQ.NBLANK )            GO TO 2930
      IF( KYTICK.EQ.NBLANK )            KYTICK = KDEFTT
C
      KYANG  = NBLANK
      LENGTH = 4
      KEYDAT(1) = 2
      KTYPE  = 0
      GO TO 3000
C
C. (D-TYPE PLOT)
 2400 IF( KYANG .EQ.NBLANK )            GO TO 2920
```

Appendix F (Continued)

```
      IF( KYLENG.EQ.NBLANK )            GO TO 2930
      IF( KYTICK.EQ.NBLANK )            KYTICK = KDEFTT
C
      KYNAME = NBLANK
      LENGTH = 4
      KEYDAT(1) = 1
      KTYPE  = 0
      GO TO 3000
C
C. (E-TYPE PLOT)
 2500 IF( KYANG .EQ.NBLANK )            GO TO 2920
      IF( KYLENG.EQ.NBLANK )            GO TO 2930
      IF( KYTICK.EQ.NBLANK )            KYTICK = KDEFTT
      IF( NADD.LE.1 )                   GO TO 2950
C
      KYNAME = NBLANK
      LENGTH = 4
      KEYDAT(1) = 1
      KTYPE  = 2
      GO TO 3000
C
C. (F-TYPE PLOT)
 2600 IF( KYANG .EQ.NBLANK )            GO TO 2920
      IF( KYLENG.EQ.NBLANK )            GO TO 2930
      IF( KYTICK.EQ.NBLANK )            KYTICK = KDEFTT
      IF( NADD.LE.1 )                   GO TO 2950
C
      KYNAME = NBLANK
      LENGTH = 4
      KEYDAT(1) = 1
      KTYPE  = 2
      GO TO 3000
C
C
C. (WRITE MATERIAL)
 2900 CONTINUE
      KYNAME = NAME
      KYANG  = NBLANK
      KYLENG = NBLANK
      KYTICK = NBLANK
      LENGTH = 6
      KEYDAT(1) = 5
      KEYDAT(2) = 2
      KEYDAT(3) = 4
      KTYPE  = 0
      GO TO 3000
C
C*****
 2910 WRITE(6,2911)
 2911 FORMAT(1X,42H* EMPTY (NAME) PARAMETER IN KEY COMMAND.   )
      GO TO 100
 2920 WRITE(6,2921)
 2921 FORMAT(1X,42H* EMPTY (ANGLE) PARAMETER IN KEY COMMAND.  )
      GO TO 100
 2930 WRITE(6,2931)
 2931 FORMAT(1X,42H* EMPTY (LENGTH) PARAMETER IN KEY COMMAND. )
      GO TO 100
 2940 WRITE(6,2941)
```

Appendix F (Continued)

```
 2941 FORMAT(1X,42H* EMPTY (THICK) PARAMETER IN KEY COMMAND.  )
      GO TO 100
 2950 WRITE(6,2951)
 2951 FORMAT(1X,33H* EMPTY PARAMETER IN ADD COMMAND.  )
      GO TO 100
C
C
C....
 3000 CONTINUE
      RETURN
      END


      SUBROUTINE    SEQENT (LDATA,LENGTH,NDATA)
C
C****   /PURPOSE/
C         SORT OPERATION WITH ALL KEYS       ( KEY LENGTH =LENGTH-2 )
C
C***    /OUTPUT/
C         LDATA      : SORTED DATA
C
C***    /INPUT/
C         DATA       : TO BE SORTED DATA
C         LENGTH     : RECORD LENGTH
C         NDATA      : NO. OF RECORDS
C
C***     PROGRAMMED BY JAERI       1989.09.08
C
C
      IMPLICIT     REAL*8 (A-H,O-Z)
C
      COMMON /FINDEX/ LEVEL,     LRANGE(2,300)
C
      DIMENSION       LDATA(LENGTH,1),   INDEX(2,2000)
C
C
C.. KEY NO. =1
      CALL QQSORT (LDATA,LENGTH,NDATA, 1,INDEX)
      LP     = 1
      KEY    = 1
      MAXKEY = LENGTH-2
      LEVEL  = 0
C
C
C.. KEY NO. >1
  100 KEY    = KEY+1
      LS     = LP
      LSAME  = LDATA(KEY-1,LS)
  200 LP     = LP+1
      IF( LP.GT.NDATA )                  GO TO 300
      IF( LDATA(KEY-1,LP).EQ.LSAME )     GO TO 200
      L2     = LP-1
      LL     = L2-LS+1
      CALL QQSORT (LDATA(1,LS),LENGTH,LL,KEY,INDEX)
      IF( KEY.NE.MAXKEY )                GO TO 250
      LE     = LS+LL-1
      LEVEL  = LEVEL+1
```

Appendix F (Continued)

```
      LRANGE(1,LEVEL) = LS
      LRANGE(2,LEVEL) = LE
C
  250 LS     = LP
      LSAME  = LDATA(KEY-1,LS)
      GO TO 200
C
  300 LL     = NDATA-LS+1
      IF( LL.LE.1 )                      GO TO 400
      CALL QQSORT (LDATA(1,LS),LENGTH,LL,KEY,INDEX)
      IF( KEY.NE.MAXKEY )                GO TO 400
      LE     = LS+LL-1
      LEVEL  = LEVEL+1
      LRANGE(1,LEVEL) = LS
      LRANGE(2,LEVEL) = LE
C
C
  400 LP     = 1
      IF( KEY.LT.MAXKEY )                GO TO 100
      RETURN
      END


      SUBROUTINE    QQSORT (LDATA,LENGTH,NDATA,KEY,INDEX)
C
C****   /PURPOSE/
C         ASCENDING SORT OPERATION
C
C***    /OUTPUT/
C         DATA       : SORTED DATA
C
C***    /INPUT/
C         LDATA      : DATA TO BE SORTED
C         LENGTH     : RECORD LENGTH
C         NDATA      : NO. OF RECORDS
C         KEY        : POSITION OF SORT KEY
C         INDEX      : WORKING AREA TO SORT
C
C***     PROGRAMMED BY JAERI       1989.09.08
C
C
      IMPLICIT     REAL*8 (A-H,O-Z)
      DIMENSION       LDATA(LENGTH,1),   INDEX(2,1)
C
C
C.. ASCENDING SORT
      KL     = 1
      KR     = NDATA
      M      = 0
C
  200 IF( KL.GE.KR )                     GO TO 400
      I      = KL-1
      J      = KR
      LPP    = LDATA(KEY,KR)
C
  210 I      = I+1
      IF( I.GE.J )                       GO TO 300
```

Appendix F (Continued)

```
      IF( LDATA(KEY,I).LE.LPP )          GO TO 210
      DO 220 L=1,LENGTH
      LWORK    = LDATA(L,I)
      LDATA(L,I) = LDATA(L,J)
  220 LDATA(L,J) = LWORK
C
C
  260 J          = J-1
      IF( I.GE.J )                       GO TO 300
      IF( LDATA(KEY,J).GT.LPP )          GO TO 260
      DO 270 L=1,LENGTH
      LWORK    = LDATA(L,J)
      LDATA(L,J) = LDATA(L,I)
  270 LDATA(L,I) = LWORK
      GO TO 210
C
C..
  300 M          = M+1
      INDEX(1,M) = KL
      INDEX(2,M) = I-1
      KL         = I+1
      GO TO 200
C
  400 IF( M.EQ.0 )                       GO TO 500
      KL         = INDEX(1,M)
      KR         = INDEX(2,M)
      M          = M-1
      GO TO 200
C
C.. END OF SORTING
  500 CONTINUE
      RETURN
      END


      SUBROUTINE    TOFIN  (LDATA,LENGTH,NDATA)
C
C****    /PURPOSE/
C          WRITE MATERIAL DATA FOR FIN ANALYSIS
C
C***     /INPUT/
C          LDATA      = MATERIAL DATA
C          LENGTH     = RECORD LENGTH
C          NDATA      = NO. OF TABLES
C
C***       PROGRAMMED BY JAERI        1989.09.13
C
C
      IMPLICIT      REAL*8 (A-H,O-Z)
C
      COMMON /FINDEX/ LEVEL,    LRANGE(2,300)
C
      DIMENSION       LDATA(LENGTH,NDATA)
      DIMENSION       DATA(6), XD(15), YD(15)
      DIMENSION       LTHICK(2,10), LANGLE(3,20)
      CHARACTER*24    FILE
C
```

Appendix F (Continued)

```
      DATA MT/  20  /
C
C
C... GET NO. OF (THICK) DATA
      NOT     = 0
      L1      = 1
      NOTICK  = LDATA(1,1)
C
      DO 100 L2=1,NDATA
      IF( LDATA(1,L2).EQ.NOTICK )        GO TO 100
      NOT     = NOT+1
      LTHICK(1,NOT) = L1
      LTHICK(2,NOT) = L2-1
      L1      = L2
      NOTICK  = LDATA(1,L2)
  100 CONTINUE
      NOT     = NOT+1
      LTHICK(1,NOT) = L1
      LTHICK(2,NOT) = NDATA
C
C
C... WRITE MATERIAL DATA
      REWIND MT
      WRITE(MT,910)            NOT
  910 FORMAT(8HMATERIAL,12X,I5,5X,26HFIN ENERGY ABSORPTION DATA)
      LINE    = 1
      LP1     = 1
C
C
C
      DO 900 LL=1,NOT
      L1      = LTHICK(1,LL)
      L2      = LTHICK(2,LL)
      WRITE(FILE,980)          (LDATA(I,L1),I=1,6)
      READ (FILE,990)          DATA
  980 FORMAT(6A4)
  990 FORMAT(F4.3,F2.0,2X,F4.2,F2.0,2X,2F4.2)
C
      DATAC1 = DATA(1) * 25.4
      WRITE(MT,920)            DATAC1
  920 FORMAT(9HTHICKNESS,1X,F10.4)
      LINE    = LINE+1
C
C... LEVEL RANGE
      DO 200 L=LP1,LEVEL
      IF( LRANGE(2,L).GT.L2 )            GO TO 250
  200 CONTINUE
      L       = LEVEL+1
  250 LP2     = L-1
C
C... GET ANGLE AND LENGTH DATA
      NOA     = 0
      NOF     = 0
      LP      = LP1
      NOANGL  = LDATA(2,L1)
C
      DO 400 L=LP1,LP2
      LS      = LRANGE(1,L)
```

Appendix F (Continued)

```
      LE      = LRANGE(2,L)
      IF( LDATA(2,LS).EQ.NOANGL )        GO TO 300
      NOA     = NOA+1
      LANGLE(1,NOA) = LP
      LANGLE(2,NOA) = L-1
      LANGLE(3,NOA) = NOF
      NOF     = 1
      LP      = L
      NOANGL = LDATA(2,LS)
      GO TO 400
  300 NOF     = NOF+1
  400 CONTINUE
      NOA     = NOA+1
      LANGLE(1,NOA) = LP
      LANGLE(2,NOA) = LP2
      LANGLE(3,NOA) = NOF
C
C...
      DO 700 K=1,NOA
      LP1     = LANGLE(1,K)
      LP2     = LANGLE(2,K)
      NOF     = LANGLE(3,K)
      LS      = LRANGE(1,LP1)
      WRITE(FILE,980)          (LDATA(I,LS),I=1,6)
      READ (FILE,990)          DATA
C
      WRITE(MT,930)            DATA(2), NOF
  930 FORMAT(5HANGLE,5X,F10.4,I5)
      LINE    = LINE+1
C
C
      DO 600 L=LP1,LP2
      LS      = LRANGE(1,L)
      LE      = LRANGE(2,L)
      NOR     = 1
      XD(1)   = 0.0
      YD(1)   = 0.0
C
      DO 500 II=LS,LE
      WRITE(FILE,980)          (LDATA(I,II),I=1,6)
      READ (FILE,990)          DATA
      NOR     = NOR+1
      XD(NOR) = DATA(4)/100.0D0
      YD(NOR) = DATA(5)
  500 CONTINUE
      IF( NOR.GT.10 )                NOR     = 10
C
      HEIGHT = DATA(3) * 25.4
      WRITE(MT,940)            HEIGHT, NOR
  940 FORMAT(5HFINH ,5X,F10.4,I5)
      LINE    = LINE+1
C
      WRITE(MT,950)            (XD(I),I=1,NOR)
      WRITE(MT,950)            (YD(I),I=1,NOR)
  950 FORMAT(8F10.4)
      LINE    = LINE+2
      IF( NOR.GT.8 )                 LINE    = LINE+2
```

Appendix F (Continued)

```
C
  600 CONTINUE
  700 CONTINUE
      LP1     = LP2+1
C
C
      WRITE(MT,960)
  960 FORMAT(3HEND,21X,1H0)
      LINE    = LINE+1
  900 CONTINUE
C
C
      WRITE(6,1000)            LINE
 1000 FORMAT(1X,5HWRITE,I6,7H CARDS.)
      RETURN
      END


      SUBROUTINE    TORNG   (LDATA,LENGTH,NDATA)
C
C****    /PURPOSE/
C          GET KEYS DATA FROM LIBRARY FILE
C
C***     /INPUT/
C          LDATA     = MATERIAL DATA
C          LENGTH    = RECORD LENGTH
C          NDATA     = NO. OF TABLES
C
C***      PROGRAMMED BY JAERI          1989.09.13
C
C
      IMPLICIT     REAL*8 (A-H,O-Z)
C
      COMMON /FINDEX/ LEVEL,     LRANGE(2,300)
C
      DIMENSION      LDATA(LENGTH,NDATA)
      DIMENSION      DATA(6)
      CHARACTER*24   FILE
C
C
C... INITIAL VALUE SET
      NOTICK = 0
      NOANGL = 0
      NOLENG = 0
C
C
C... LEVEL RANGE
      DO 700 L=1,LEVEL
      LS      = LRANGE(1,L)
      LE      = LRANGE(2,L)
      WRITE(FILE,980)          (LDATA(I,LS),I=1,6)
      READ (FILE,990)          DATA
  980 FORMAT(6A4)
  990 FORMAT(F4.3,F2.0,2X,F4.2,F2.0,2X,2F4.2)
C...
      IF( LDATA(1,LS).EQ.NOTICK )        GO TO 200
      WRITE(6,100)             DATA(1), DATA(2), DATA(3)
  100 FORMAT(10X,9H  THICK =,F6.3,9H  ANGLE =,F6.3,9H  LENGTH=,F6.3)
```

Appendix F (Continued)

```
C
      NDTICK = LDATA(1,LS)
      NOANGL = LDATA(2,LS)
      NOLENG = LDATA(3,LS)
      GO TO 700
C...
  200 IF( LDATA(2,LS).EQ.NOANGL )          GO TO 400
      WRITE(6,300)                DATA(2), DATA(3)
  300 FORMAT(25X,9H  ANGLE =,F6.3,9H  LENGTH=,F6.3)
C
      NOANGL = LDATA(2,LS)
      NOLENG = LDATA(3,LS)
      GO TO 700
C...
  400 IF( LDATA(3,LS).EQ.NOLENG )          GO TO 700
      WRITE(6,500)                DATA(3)
  500 FORMAT(40X,9H  LENGTH=,F6.3)
C
      NOLENG = LDATA(3,LS)
  700 CONTINUE
      RETURN
      END


      SUBROUTINE     KPLOTX (LDATA,LENGTH,NDATA)
C
C****   /PURPOSE/
C         MATERIAL DATA PLOTTING CONTROL
C
C***    /INPUT/
C         LDATA      = MATERIAL DATA
C         LENGTH     = RECORD LENGTH
C         NDATA      = NO. OF TABLES
C
C***     PROGRAMMED BY JAERI        1989.09.12
C
C
      IMPLICIT      REAL*8 (A-H,O-Z)
C
      COMMON /MODEL/  MPLOT,    NTITLE(18), KEYDAT(5)
      COMMON /FINDEX/ LEVEL,    LRANGE(2,300)
      COMMON /RVALUE/ ANGLE,    HEIGHT,    THICK,     KNAME
C
      DIMENSION       LDATA(LENGTH,NDATA)
      DIMENSION       XD(15,10), YD(15,10), ZD(15,10), DATA(3)
      DIMENSION       LABEL(3,10), MLENG(10), KOPT(4), MHEAD(3)
      CHARACTER*12    FILE
C
      DATA MHEAD/  4H A =,  4H T =,  4H H =/
      DATA NBLANK/ 4H    /
      DATA MONSER/ 4HAVEL/
C
C
C... DATA ADDRESS AND INITIAL SET
      K1      = LENGTH-2
      K2      = LENGTH
      DO 50 I=1,4
```


Appendix F (Continued)

```
   50 KOPT(I) = 1
C
C
C... RESET MATERIAL DATA
      NOF     = LEVEL
C
      DO 300 L=1,LEVEL
      LS      = LRANGE(1,L)
      LE      = LRANGE(2,L)
      N       = 0
      DO 100 I=LS,LE
      N       = N+1
      WRITE(FILE,80)                   (LDATA(KK,I),KK=K1,K2)
      READ (FILE,90)                    DATA
   80 FORMAT(A2,2H.0,2A4)
   90 FORMAT(F4.1,2F4.2)
      XD(N,L) = DATA(1)
      YD(N,L) = DATA(2)
      ZD(N,L) = DATA(3)
  100 CONTINUE
      MLENG(L) = N
C
C
      GO TO ( 110, 120, 130, 140, 150, 160 )       , MPLOT
C. (A-TYPE)
  110 LABEL(1,L) = MHEAD(3)
      WRITE(FILE,111)          LDATA(1,LS)
  111 FORMAT(A4,8X)
      FILE(5:5) = FILE(4:4)
      FILE(4:4) = FILE(3:3)
      FILE(3:3) = '.'
      READ (FILE,112)          LABEL(2,L), LABEL(3,L)
  112 FORMAT(2A4)
      GO TO 300
C. (B-,D-,F-TYPE)
  120 CONTINUE
  140 CONTINUE
  160 CONTINUE
      LABEL(1,L) = LDATA(1,LS)
      LABEL(2,L) = NBLANK
      LABEL(3,L) = NBLANK
      GO TO 300
C. (C-TYPE)
  130 LABEL(1,L) = MHEAD(1)
      WRITE(FILE,111)          LDATA(1,LS)
      FILE(5:5) = FILE(4:4)
      FILE(4:4) = FILE(3:3)
      FILE(3:3) = '.'
      READ (FILE,112)          LABEL(2,L), LABEL(3,L)
      GO TO 300
C. (E-TYPE)
  150 LABEL(1,L) = MONSER
      LABEL(2,L) = NBLANK
      LABEL(3,L) = NBLANK
C
C
  300 CONTINUE
C
```

Appendix F (Continued)

```
C
C... SET (KOPT)
      GO TO ( 410, 420, 430, 440, 450, 460 )      , MPLOT
  410 KOPT(4) = 0
      GO TO 1000
  420 KOPT(1) = 0
      GO TO 1000
  430 KOPT(2) = 0
      GO TO 1000
  440 KOPT(1) = 0
      GO TO 1000
  460 KOPT(1) = 0
      GO TO 1000
C
  450 KNAME  = MONSER
      MAX    = 0
      DO 500 I=1,NOF
      IF( MLENG(I).LE.MAX )                GO TO 500
      MAX    = MLENG(I)
      IL     = I
  500 CONTINUE
      IF( IL.EQ.1 )                        GO TO 600
      DO 550 I=1,MAX
      A      = XD(I,1)
      XD(I,1)  = XD(I,IL)
      XD(I,IL) = A
      A      = YD(I,1)
      YD(I,1)  = YD(I,IL)
      YD(I,IL) = A
      A      = ZD(I,1)
      ZD(I,1)  = ZD(I,IL)
      ZD(I,IL) = A
  550 CONTINUE
      MLENG(IL) = MLENG(1)
      MLENG(1)  = MAX
C
  600 CONTINUE
      DO 800 II=1,MAX
      N      = 1
      DO 700 IL=2,NOF
      IF( MLENG(IL).GE.II )                N      = N+1
  700 CONTINUE
      AVERAG = 1.0D0/FLOAT(N)
C
      YD(II,1) = AVERAG*YD(II,1)
      ZD(II,1) = AVERAG*ZD(II,1)
      DO 750 IL=2,NOF
      IF( MLENG(IL).LT.II )                GO TO 750
      YD(II,1) = YD(II,1) + AVERAG*YD(II,IL)
      ZD(II,1) = ZD(II,1) + AVERAG*ZD(II,IL)
  750 CONTINUE
  800 CONTINUE
      NOF    = 1
C
C
C....
 1000 CONTINUE
      CALL KPLOT  (KOPT,KNAME,ANGLE,THICK,HEIGHT,NOF,MLENG,
```

Appendix F (Continued)

```
     +             XD,YD,ZD,LABEL,NTITLE)
      RETURN
      END


      SUBROUTINE    KPLOT (KOPT,KNAME,ANGLE,THICK,HEIGHT,NOF,MLENG,
     +                     XD,YD,ZD,LABEL,NTITLE)
C
C****   /PURPOSE/
C         MATERIAL DATA PLOTTING
C
C***    /INPUT/
C         KOPT       = OPTION FLAG OF COMPONENT MESSAGE
C         KNAME      = MATERIAL NAME
C         ANGLE      = ANGLE
C         THICK      = THICKNESS
C         HEIGHT     = FIN HEIGHT
C         NOF        = NO. OF PARAMETERS
C         MLENG      = NO. OF VARIABLES FOR (XD), (YD) AND (ZD)
C         XD         = VALUES OF X AXIS
C         YD         = VALUES OF Y AXIS
C         ZD         = VALUES OF Y RANGE
C         LABEL      = LINE TITLES
C         NTITLE     = MAIN TITLE MESSAGE
C
C***     PROGRAMMED BY JAERI        1989.09.12
C
C
      IMPLICIT      REAL*8 (A-H,O-Z)
      DIMENSION       KOPT(4), MLENG(10), LABEL(3,10), NTITLE(18)
      DIMENSION       XD(15,10), YD(15,10), ZD(15,10)
      DIMENSION       X(5),      Y(5),      KSCL(2),  MHEAD(6,2)
C
      DATA MHEAD/  4H RAT, 4HIO O, 4HF DE, 4HFORM, 4HATIO, 4HN    ,
     +             4HPLAS, 4HTIC , 4HMOME, 4HNT   , 4HEP  , 4H     /
      DATA KSCL/   4H(10 , 4H )  /
      DATA NPARTX,NPARTY/  10, 8 /
      DATA XL,YL/  200.0,  160.0 /
      DATA XO,YO,DH/ 40.0, 30.0, 20.0 /
      DATA HH,H2,H3/  2.5,  2.0,  1.5 /
      DATA EPS/   1.0D-10 /
C
C...    FUNCTION
      ABS(Z)     = DABS(Z)
C
C
C...    DATA RANGE
C
      CALL GSCAL3 (NOF, MLENG, XD, YD, ZD, XMN, YMN, XMX, YMX, FACT)
      IF( ABS(XMX-XMN).LE.EPS )     GO TO 1000
      IF( ABS(YMX-YMN).LE.EPS )     GO TO 1000
C
      CALL XYSCAL ( XMN, XMX, NPARTX, DX, NEXPX )
      CALL XYSCAL ( YMN, YMX, NPARTY, DY, NEXPY )
C
C...    GRID MESH
```

Appendix F (Continued)

```
C
      CALL PLPEN( 1 )
      X(1)    = X0
      X(2)    = X0+XL
      X(3)    = X0+XL
      X(4)    = X0
      X(5)    = X0
      Y(1)    = Y0
      Y(2)    = Y0
      Y(3)    = Y0+YL
      Y(4)    = Y0+YL
      Y(5)    = Y0
      CALL PLINES ( X, Y, 5 )
C. (X) SCALE
      Y(1)    = Y0-2.0
      Y(2)    = Y0+2.0
      Y(3)    = Y0-5.0
      Y(4)    = Y0+YL-2.0
      Y(5)    = Y0+YL
      X(1)    = X0
      X(2)    = X0
      DNO     = 0.0
      LPARTX = NPARTX+1
      DO 300 J= 1, LPARTX
      CALL PLINES ( X, Y, 2 )
      CALL PLINES ( X, Y(4), 2)
      X(3)    = X(1)-H2
      CALL PNUMB  ( X(3), Y(3), H2, DNO, 0.0D0, 1 )
      X(1)    = X(1)+DH
      X(2)    = X(2)+DH
      DNO     = DNO+DX
  300 CONTINUE
      IF( NEXPX.EQ.0 )                GO TO 350
      X(3)    = X0+XL+4.0*H2
      CALL PSYM   ( X(3), Y(3), H2, KSCL, 0.0D0, 6 )
      X(3)    = X0+XL+7.0*H2
      Y(3)    = Y(3)+H3
      CALL PNUMBR ( X(3), Y(3), H3, NEXPX, 0.0D0 )
C. (Y) SCALE
  350 X(1)    = X0-2.0
      X(2)    = X0+2.0
      X(3)    = X0-5.0*H2
      X(4)    = X0+XL-2.0
      X(5)    = X0+XL
      Y(1)    = Y0
      Y(2)    = Y0
      DNO     = 0.0
      LPARTY = NPARTY+1
      DO 400 J= 1, LPARTY
      CALL PLINES ( X, Y, 2 )
      CALL PLINES ( X(4), Y, 2 )
      Y(3)    = Y(1)
      CALL PNUMB  ( X(3), Y(3), H2, DNO, 0.0D0, 1 )
      Y(1)    = Y(1)+DH
      Y(2)    = Y(2)+DH
      DNO     = DNO+DY
  400 CONTINUE
      IF( NEXPY.EQ.0 )                GO TO 500
```

Appendix F (Continued)

```
      X(3)    = X0
      Y(3)    = Y0+YL+H2
      CALL PSYM   ( X(3), Y(3), H2, KSCL, 0.0D0, 6 )
      X(3)    = X0+3.0*H2
      Y(3)    = Y(3)+H3
      CALL PNUMBR ( X(3), Y(3), H3, NEXPY, 0.0D0 )
C
C...    HEADER PLOT
C
  500 CONTINUE
      XX      = X0+12.0*HH
      YY      = Y0+YL+3.0*HH
      IF( KOPT(1).EQ.0 )              GO TO 510
      CALL PSYM   ( XX, YY, HH, 8H  NAME =,   0.0D0, 8 )
      XX      = XX+8.0*HH
      CALL PSYM   ( XX, YY, HH, KNAME,        0.0D0, 4 )
      XX      = XX+10.0*HH
C
  510 IF( KOPT(2).EQ.0 )              GO TO 520
      CALL PSYM   ( XX, YY, HH, 8H ANGLE =,   0.0D0, 8 )
      XX      = XX+8.0*HH
      CALL PNUMB  ( XX, YY, HH, ANGLE,        0.0D0, 1 )
      XX      = XX+10.0*HH
C
  520 IF( KOPT(3).EQ.0 )              GO TO 530
      CALL PSYM   ( XX, YY, HH, 8H THICK =,   0.0D0, 8 )
      XX      = XX+8.0*HH
      CALL PNUMB  ( XX, YY, HH, THICK,        0.0D0, 3 )
      XX      = XX+12.0*HH
C
  530 IF( KOPT(4).EQ.0 )              GO TO 550
      CALL PSYM   ( XX, YY, HH, 8H HEIGHT=,   0.0D0, 8 )
      XX      = XX+8.0*HH
      CALL PNUMB  ( XX, YY, HH, HEIGHT,       0.0D0, 2 )
C
C. (TITLE)
C
  550 CONTINUE
      XX      = X0+10.0*HH
      YY      = Y0-9.0*HH
      CALL PSYM   ( XX, YY, HH, NTITLE,       0.0D0, 72 )
C
C. (X-TITLE)
      XX      = X0+20.0*HH
      YY      = Y0-5.0*HH
      CALL PSYM   ( XX, YY, HH, MHEAD(1, 1), 0.0D0,  24 )
C
C. (Y-TITLE)
      XX      = 0.4*X0
      YY      = Y0+20.0*HH
      CALL PSYM   ( XX, YY, HH, MHEAD(1, 2), 90.0D0, 24 )
C
C
C...     XYPLOT
C
  600 CONTINUE
      CALL PLPEN( 2 )
      PX      = DX* 10.0**NEXPX
```

Appendix F (Continued)

```
      PY     = DY* 10.0**NEXPY
      XFACT  = DH/PX
      YFACT  = DH/PY
C
      R      = 1.0
      DO 900 JJ= 1, NOF
      LENGTH = MLENG(JJ)
      X(1)   = XO
      Y(1)   = YO
C
      DO 700 J= 1, LENGTH
      X(2)   = XFACT*XD(J,JJ) + XO
      Y(2)   = YFACT*YD(J,JJ) + YO
      CALL PLINES ( X, Y, 2 )
CRC   CALL PLMARK ( X(2), Y(2), R )
      X(1)   = X(2)
      Y(1)   = Y(2)
C
      X(3)   = X(2)
      X(4)   = X(2)
      Y(3)   = YFACT*(YD(J,JJ)-ZD(J,JJ)) + YO
      Y(4)   = YFACT*(YD(J,JJ)+ZD(J,JJ)) + YO
      CALL PLINES ( X(3), Y(3), 2 )
  700 CONTINUE
C
      X(2)   = X(2)+H2
      CALL PSYM   ( X(2), Y(2), H2, LABEL(1,JJ), 0.0D0, 12 )
  900 CONTINUE
C
      CALL PLTEOR
 1000 CONTINUE
      RETURN
      END


      SUBROUTINE    XYSCAL ( VMIN, VMAX, NPART, DSIZE , NEXP )
C
C****   /PURPOSE/
C         XYPLOT SCALING
C
C***    /OUTPUT/
C         DSIZE      = ADDITIONAL VALUE
C         NEXP       = EXPONENT NUMBER
C
C***    /INPUT/
C         VMIN       = MINIMUM VALUE
C         VMAX       = MAXIMUM VALUE
C         NPART      = NO. OF DIVISION
C
C***     PROGRAMMED BY JAERI        1989.09.11
C
C
      IMPLICIT     REAL*8 (A-H,O-Z)
      DIMENSION DVAL(10)
      DATA EPS/  1.0D-20 /
      DATA DVAL/ 0.5, 1.0, 1.5, 2.0, 2.5, 5.0, 7.0, 8.0, 10.0, 15.0 /
C
```

Appendix F (Continued)

```
C...     FUNCTION
      ABS(Z)    = DABS(Z)
      ALOG10(Z) = DLOG10(Z)
C
C...
C
      DPART  = NPART
      XMIN   = 0.0
      DS     = (VMAX-XMIN)/DPART
      IF( DS.LT.EPS )          GO TO 900
      NEXP   = ALOG10 (DS)
      IF( NEXP.LT.0 )          NEXP  = NEXP-1
      GVAL   = 10.0**NEXP
C
      HWIDE  = DS/GVAL
      DO 100 J= 1, 9
      IF( HWIDE.LE.DVAL(J) )   GO TO 200
  100 CONTINUE
      J      = 9
  200 DSIZE  = DVAL(J)
C
      RETURN
C
C
C
  900 CONTINUE
      NEXP   = 0
      DSIZE  = DVAL(2)
      AA     = ABS(XMIN)
      IF( AA.LT.EPS )          GO TO 950
      NEXP   = ALOG10 (AA)
      IF( NEXP.LT.0 )          NEXP  = NEXP-1
C
  950 CONTINUE
      RETURN
      END


      SUBROUTINE     GSCAL3 ( NOF, MLENG, XD, YD, ZD,
     +                        XMN, YMN, XMX, YMX, SCALEG )
C
C****   /PURPOSE/
C         GET SCALING FACTOR OF THE GEOMETRY PLOT
C
C***    /OUTPUT/
C         XMN        = X MINIMUM
C         YMN        = Y MINIMUM
C         XMX        = X MAXIMUM
C         YMX        = Y MAXIMUM
C         SCALEG     = SCALING FACTOR
C
C***    /INPUT/
C         NOF        = NO. OF LINES
C         MLENG      = NO. OF VARIABLES AT EACH LINE
C         XD         = X COORNINATES
C         YD         = Y COORNINATES
C         ZD         = Y INCREMENTS
C
```

Appendix F (Continued)

```
C***     PROGRAMMED BY JAERI        1989.09.11
C
C
      IMPLICIT      REAL*8 (A-H,O-Z)
      DIMENSION MLENG(1)
      DIMENSION XD(15,1), YD(15,1), ZD(15,1)
      DATA PAPER/ 180.0 /
C
C...     FUNCTION
      AMIN1 (Z1,Z2) = DMIN1 (Z1,Z2)
      AMAX1 (Z1,Z2) = DMAX1 (Z1,Z2)
C
C...     GEOMETRY RANGE
C
      XMN     =  1.0D20
      YMN     =  1.0D20
      XMX     = -1.0D20
      YMX     = -1.0D20
C
C
C
      DO 200 J= 1, NOF
      ND      = MLENG(J)
C
      DO 100 I= 1, ND
      XI      = XD(I,J)
      XMN     = AMIN1 (XMN,XI)
      XMX     = AMAX1 (XMX,XI)
      YI      = YD(I,J)-ZD(I,J)
      YMN     = AMIN1 (YMN,YI)
      YMX     = AMAX1 (YMX,YI)
      YI      = YD(I,J)+ZD(I,J)
      YMN     = AMIN1 (YMN,YI)
      YMX     = AMAX1 (YMX,YI)
  100 CONTINUE
  200 CONTINUE
C
      XMX     = 1.15D0*XMX
      YMX     = 1.15D0*YMX
C
      XS      = XMX-XMN
      YS      = YMX-YMN
      AS      = AMAX1 (XS,YS)
      SCALEG  = PAPER/AS
      RETURN
      END


      SUBROUTINE    PLTBGN
      IMPLICIT      REAL*8 (A-H,O-Z)
      CALL  PLOTS (0.0D0,0.0D0,10)
      RETURN
      END
```

Appendix F (Continued)

```
      SUBROUTINE    PLPEN (NO)
      CALL  NEWPEN (NO)
      RETURN
      END


      SUBROUTINE    PLINES ( X,Y,NN )
      IMPLICIT      REAL*8 (A-H,O-Z)
      DIMENSION       X(1), Y(1)
      REAL*4          XX, YY
C
      XX     =X(1)
      YY     =Y(1)
      CALL  PLOT (XX,YY,3)
      IF( NN.EQ.1 )            RETURN
      DO 10 I=2,NN
      XX     =X(I)
      YY     =Y(I)
      CALL  PLOT (XX,YY,2)
   10 CONTINUE
      RETURN
      END


      SUBROUTINE    PLMARK ( XO,YO,R )
      IMPLICIT      REAL*8 (A-H,O-Z)
      DIMENSION   CR(2,9), X(9), Y(9)
      DATA CR/ 0.92388,  0.38268,       0.38268,  0.92388,
     +        -0.38268,  0.92388,      -0.92388,  0.38268,
     +        -0.92388, -0.38268,      -0.38268, -0.92388,
     +         0.38268, -0.92388,       0.92388, -0.38268,
     +         0.92388,  0.38268/
C
      DO 10 J=1,9
      X(J) =R*CR(1,J) + XO
   10 Y(J) =R*CR(2,J) + YO
C
      CALL  PLINES ( X, Y, 9 )
      RETURN
      END


      SUBROUTINE    PSYM   ( X,Y,H,NTIT,ANG,NL )
      IMPLICIT      REAL*8 (A-H,O-Z)
      DIMENSION       NTIT(1)
      REAL*4          XX, YY, HH, ANGL
C
      XX     =X
      YY     =Y
      HH     =H
      ANGL   =ANG
      CALL  SYMBOL (XX,YY,HH,NTIT,ANGL,NL)
      RETURN
      END
```

Appendix F (Continued)

```
      SUBROUTINE     PNUMB  ( X,Y,H,AN,ANG,N )
      IMPLICIT      REAL*8 (A-H,O-Z)
      REAL*4            XX, YY, HH, ANGL, ANN
C
      XX     =X
      YY     =Y
      HH     =H
      ANGL   =ANG
      ANN    =AN
      CALL   NUMBER (XX,YY,HH,ANN,ANGL,N)
      RETURN
      END


      SUBROUTINE     PNUMBR ( X,Y,H,N,ANG )
      IMPLICIT      REAL*8 (A-H,O-Z)
      REAL*4            XX, YY, HH, ANGL, ANN
C
      XX     =X
      YY     =Y
      HH     =H
      ANGL   =ANG
      ANN    =N
      CALL   NUMBER (XX,YY,HH,ANN,ANGL,-1)
      RETURN
      END


      SUBROUTINE     PLTEOR
      IMPLICIT      REAL*8 (A-H,O-Z)
      REAL*4            XX, YY
C
      XX     =300.0
      YY     =0.0
      CALL   PLOT (XX,YY,-3)
      XX     =0.0
      CALL   PLOT ( XX, YY, 666 )
      CALL   PLOT ( XX, YY, 777 )
      CALL   PLOT ( XX, YY, 888 )
      RETURN
      END


      SUBROUTINE     PLTEND
      IMPLICIT      REAL*8 (A-H,O-Z)
      REAL*4            XX, YY
C
      XX     =0.0
      YY     =0.0
      CALL   PLOT (XX,YY,999)
      RETURN
      END
```

Appendix F (Continued)

```
      SUBROUTINE DTLIST(LU1,LU2)
      DIMENSION IA(20)
      REWIND LU1
      N = 1
      L = 51
   15 IF ( L .LE. 50 ) GO TO 30
   20 WRITE(LU2,2)
      WRITE(LU2,3) ( I, I=1,8 )
      WRITE(LU2,4)
      L = 1
   30 READ(LU1,1,END=50) ( IA(I),I=1,20 )
      WRITE(LU2,5)     N,( IA(I),I=1,20 ),N
      IF ( L .NE. 50 ) GO TO 40
      WRITE(LU2,6)
      WRITE(LU2,10) ( I, I=1,8 )
      WRITE(LU2,7)
   40 L = L + 1
      N = N + 1
      GO TO 15
   50 CONTINUE
      WRITE(LU2,6)
      WRITE(LU2,10) ( I, I=1,8 )
      WRITE(LU2,8)
      WRITE(LU2,9) LU1
      REWIND LU1
    1 FORMAT( 20A4 )
    2 FORMAT( 1H1, //, 50X, '    INPUT DATA ECHO ' / )
    3 FORMAT( 16X, 'DATA ', 4X, 8( 9X, I1 ) )
    4 FORMAT( 14X, 'SEQ. NO.', 3X, 8('----5----0'), / )
    5 FORMAT( 16X, I4, 5X, 20A4, 2X, I4 )
    6 FORMAT( 1H0, 24X, 8('----5----0') )
    7 FORMAT(1H0, 30X, '* * *  CONTINUE  * * *' )
    8 FORMAT(1H0, 30X, '* * *  INPUT DATA END  * * *' )
    9 FORMAT(1H0,30X,'* * *  INPUT DATA FROM FILE NO. =',I3,' * * *' )
   10 FORMAT( 25X, 8(9X,I1) )
   11 FORMAT(1H0)
      RETURN
      END
```

Appendix G Fin Energy Absorption Data

```
         1         2         3         4         5         6         7         8
----5----0----5----0----5----0----5----0----5----0----5----0----5----0----5----0

:       A=0.0,     H=3.5
MWID00050350025004490024
MWID00100350025006180053
MWID00150350025007300063
MWID00200350025007660028
MWID00250350025007950000
MPAR00050350025004570025
MPAR00100350025006100066
MPAR00150350025007560085
MPAR00200350025008230104
MPAR00250350025009100099
MPAR00300350025009730101
MPAR00400350025010780027
MCON00050350025004470035
MCON00100350025006120068
MCON00150350025007680100
MCON00200350025008440134
MCON00250350025009300126
MCON00300350025009940124
MCON00400350025010710024
MBRA00050350025004150017
MBRA00100350025005720013
MBRA00150350025007240018
MBRA00200350025007920020
MBRA00250350025008810018
MBRA00300350025009620019
MBRA00400350025010940026
MBRA00500350025011970000
MOAK00050350025004350032
MOAK00100350025005310034
MOAK00150350025006480040
MOAK00200350025007000035
MOAK00250350025007890037
MOAK00300350025008210050
MOAK00400350025009450034
MOAK00500350025011710044
:
MWID00050350037502970014
MWID00100350037505900019
MWID00150350037507520015
MPAR00050350037503150019
MPAR00100350037505400038
MPAR00150350037507190018
MCON00050350037503240007
MCON00100350037505670029
MCON00150350037507090022
MCON00200350037508340033
MBRA00050350037502350036
MBRA00100350037504610022
MBRA00150350037506190020

----5----0----5----0----5----0----5----0----5----0----5----0----5----0----5----0
         1         2         3         4         5         6         7         8
```

Appendix G (Continued)

```
         1         2         3         4         5         6         7         8
----5----0----5----0----5----0----5----0----5----0----5----0----5----0----5----0

MBRA00200350037507440023
MBRA00250350037508450019
MOAK00050350037503370005
MOAK00100350037505580011
MOAK00150350037507350013
MOAK00200350037508600017
MOAK00250350037509610024
MOAK00300350037510270017
:       A=0.0,     H=4.0
MWID00050400025004810041
MWID00100400025006240055
MWID00150400025006960040
MWID00200400025007590023
MWID00250400025007880000
MPAR00050400025005110039
MPAR00100400025006030048
MPAR00150400025007470057
MPAR00200400025008290079
MPAR00250400025008980094
MPAR00300400025009640105
MPAR00400400025010570047
MCON00050400025004930065
MCON00100400025005860045
MCON00150400025007330045
MCON00200400025008030061
MCON00250400025008650061
MCON00300400025009290060
MCON00400400025010720060
MBRA00050400025004520025
MBRA00100400025005430024
MBRA00150400025006860026
MBRA00200400025007670034
MBRA00250400025008310037
MBRA00300400025009000036
MBRA00400400025010220040
MBRA00500400025011610024
MOAK00050400025004330019
MOAK00100400025004830022
MOAK00150400025006150025
MOAK00200400025006490031
MOAK00250400025007160027
MOAK00300400025007690033
MOAK00400400025009300036
MOAK00500400025011590029
:
MWID00050400037503650013
MWID00100400037506170018
MWID00150400037507540003
MPAR00050400037503030071
MPAR00100400037505050049

----5----0----5----0----5----0----5----0----5----0----5----0----5----0----5----0
         1         2         3         4         5         6         7         8
```

Appendix G (Continued)

```
         1         2         3         4         5         6         7         8
----5----0----5----0----5----0----5----0----5----0----5----0----5----0----5----0

MPAR00150400037506270044
MPAR00200400037506840018
MCON00050400037503290070
MCON00100400037505430014
MCON00150400037506630011
MBRA00050400037502380060
MBRA00100400037504490023
MBRA00150400037505680022
MBRA00200400037506630022
MBRA00250400037507050000
MOAK00050400037504020023
MOAK00100400037506230088
MOAK00150400037507150051
MOAK00200400037507660000
:      A=0.0,     H=6.0
MWID00050600025004690043
MWID00100600025005700067
MWID00150600025006520091
MWID00200600025006800073
MWID00250600025006820012
MWID00300600025007070014
MWID00400600025007770000
MPAR00050600025005630043
MPAR00100600025006600061
MPAR00150600025007230070
MPAR00200600025007940072
MPAR00250600025008540071
MPAR00300600025008980074
MPAR00400600025010250055
MPAR00500600025011610049
MCON00050600025004690137
MCON00100600025005390178
MCON00150600025006180148
MCON00200600025007000134
MCON00250600025007630128
MCON00300600025008270145
MCON00400600025009510133
MCON00500600025011020135
MBRA00050600025005230038
MBRA00100600025006400043
MBRA00150600025007130053
MBRA00200600025007840054
MBRA00250600025008460055
MBRA00300600025009020065
MBRA00400600025010410062
MBRA00500600025011640019
MOAK00050600025006680035
MOAK00100600025006430084
MOAK00150600025007300063
MOAK00200600025008120056

----5----0----5----0----5----0----5----0----5----0----5----0----5----0----5----0
         1         2         3         4         5         6         7         8
```

Appendix G (Continued)

```
         1         2         3         4         5         6         7         8
----5----0----5----0----5----0----5----0----5----0----5----0----5----0----5----0

MOAK00250600025008720066
MOAK00300600025009080074
MOAK00400600025010100109
MOAK00500600025010380076
:
MWID00050600037505210023
MWID00100600037506380030
MWID00150600037507140023
MWID00200600037507700000
MPAR00050600037503700024
MPAR00100600037504760033
MPAR00150600037505580036
MPAR00200600037506250040
MPAR00250600037506840045
MPAR00300600037506850038
MCON00050600037503450078
MCON00100600037504460105
MCON00150600037505270123
MCON00200600037505930137
MCON00250600037506200152
MCON00300600037505770217
MCON00400600037504850000
MCON00500600037505270000
MBRA00050600037503490029
MBRA00100600037504670037
MBRA00150600037505540041
MBRA00200600037506270038
MBRA00250600037506680039
MBRA00300600037506820000
MOAK00050600037503620023
MOAK00100600037504460020
MOAK00150600037505170024
:      A=0.0,     H=8.0
MWID00050800025004690018
MWID00100800025005720020
MWID00150800025006440032
MWID00200800025007050045
MWID00250800025007370027
MWID00300800025007860011
MPAR00050800025004890038
MPAR00100800025006000083
MPAR00150800025006900107
MPAR00200800025006970024
MPAR00250800025007470024
MPAR00300800025007960026
MPAR00400800025009060011
MCON00050800025005450048
MCON00100800025006690051
MCON00150800025007450054
MCON00200800025008070056

----5----0----5----0----5----0----5----0----5----0----5----0----5----0----5----0
         1         2         3         4         5         6         7         8
```

Appendix G (Continued)

```
         1         2         3         4         5         6         7         8
----5----0----5----0----5----0----5----0----5----0----5----0----5----0----5----0

MCON00250800025008520034
MCON00300800025008890000
MBRA00050800025003830122
MBRA00100800025005020127
MBRA00150800025005900120
MBRA00200800025006580111
MBRA00250800025007140110
MBRA00300800025007370085
MBRA00400800025008550051
MOAK00050800025005350064
MOAK00100800025006740094
MOAK00150800025007570124
MOAK00200800025008200142
MOAK00250800025007770138
MOAK00300800025008390140
MOAK00400800025007230000
MOAK00500800025008760000
:
MWID00050800037505510066
MWID00100800037506130013
MWID00150800037506890014
MWID00200800037507420020
MWID00250800037507650000
MPAR00050800037504230035
MPAR00100800037505220039
MPAR00150800037505780015
MCON00050800037503730039
MCON00100800037504910050
MCON00150800037505670049
MCON00200800037505730000
MBRA00050800037503910036
MBRA00100800037504880039
MBRA00150800037505660034
MBRA00200800037506060006
MOAK00050800037503960028
MOAK00100800037505120023
MOAK00150800037505840011
MOAK00200800037506350013
:       A=0.0,     H=10.0
MWID00051000025004390065
MWID00101000025005490060
MWID00151000025005960024
MWID00201000025006490032
MPAR00051000025002100260
MPAR00101000025002400168
MPAR00151000025004200080
MPAR00201000025004220021
MPAR00251000025004870047
MPAR00301000025005290048
MPAR00401000025006310074

----5----0----5----0----5----0----5----0----5----0----5----0----5----0----5----0
         1         2         3         4         5         6         7         8
```

Appendix G (Continued)

```
         1         2         3         4         5         6         7         8
----5----0----5----0----5----0----5----0----5----0----5----0----5----0----5----0

MPAR00501000025006730059
MCON00051000025005310028
MCON00101000025006140023
MCON00151000025006800022
MCON00201000025007350019
MCON00251000025008040017
MCON00301000025009090016
MBRA00051000025005040016
MBRA00101000025006120029
MBRA00151000025006900036
MBRA00201000025007480040
MBRA00251000025008110044
MBRA00301000025008610031
MOAK00051000025002780014
MOAK00101000025003620013
MOAK00151000025003970013
MOAK00201000025004220010
MOAK00251000025004410009
MOAK00301000025004580007
MOAK00401000025004990018
MOAK00501000025005420053
:
MWID00051000037505000011
MWID00101000037505890008
MWID00151000037506610012
MWID00201000037507160012
MWID00251000037507540009
MPAR00051000037504690024
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MPAR00151000037506370036
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MCON00051000037504650048
MCON00101000037505780071
MCON00151000037506280060
MCON00201000037506380055
MCON00251000037506440000
MCON00301000037506950000
MBRA00051000037504370030
MBRA00101000037505300033
MBRA00151000037506000035
MBRA00201000037506580038
MBRA00251000037506670012
MOAK00051000037504380031
MOAK00101000037505150025
MOAK00151000037505710030
MOAK00201000037506200027
MOAK00251000037506320000
MOAK00301000037506540000
:       A=10.0,     H=3.5
MWID10050350025003560016

----5----0----5----0----5----0----5----0----5----0----5----0----5----0----5----0
         1         2         3         4         5         6         7         8
```

Appendix G (Continued)

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         1         2         3         4         5         6         7         8
----5----0----5----0----5----0----5----0----5----0----5----0----5----0----5----0

MWID10100350025004270021
MWID10150350025004950043
MWID10200350025005370063
MWID10250350025005800066
MWID10300350025006110066
MWID10400350025006620065
MWID10500350025006580010
MPAR10050350025003590035
MPAR10100350025004830057
MPAR10150350025005630087
MPAR10200350025006600067
MPAR10250350025007340099
MPAR10300350025007980090
MPAR10400350025009170107
MPAR10500350025010220124
:
MWID10050350037502440007
MWID10100350037503690052
MWID10150350037503720055
MWID10200350037504530059
MWID10250350037505210052
MWID10300350037505360065
MWID10400350037505640047
MWID10500350037506060043
MPAR10050350037501870008
MPAR10100350037502290013
MPAR10150350037503190028
MPAR10200350037503690033
MPAR10250350037504380038
MPAR10300350037504910041
MPAR10400350037505520049
MPAR10500350037505610005
:     A=10.0,     H=4.0
MWID10050400025003930026
MWID10100400025004260059
MWID10150400025005060054
MWID10200400025005660068
MWID10250400025005830033
MWID10300400025006180039
MWID10400400025006330002
MWID10500400025006700001
MPAR10050400025003460077
MPAR10100400025003640127
MPAR10150400025004800167
MPAR10200400025005640190
MPAR10250400025006260212
MPAR10300400025006270223
MPAR10400400025005920195
MPAR10500400025006350217
:

----5----0----5----0----5----0----5----0----5----0----5----0----5----0----5----0
         1         2         3         4         5         6         7         8
```

Appendix G (Continued)

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         1         2         3         4         5         6         7         8
----5----0----5----0----5----0----5----0----5----0----5----0----5----0----5----0

MPAR10050400037502290049
MPAR10100400037502480088
MPAR10150400037503200100
MPAR10200400037503680118
MPAR10250400037503790020
MPAR10300400037504260022
MPAR10400400037504860028
MPAR10500400037505310032
:     A=10.0,     H=6.0
MWID10050600025003030054
MWID10100600025002510048
MWID10150600025003350035
MWID10200600025003890026
MWID10250600025004150028
MWID10300600025004310037
MWID10400600025004420027
MWID10500600025004890002
MPAR10050600025002710058
MPAR10100600025002700103
MPAR10150600025003450090
MPAR10200600025003480036
MPAR10250600025003510064
MPAR10300600025003700055
MPAR10400600025003950050
MPAR10500600025004120057
:
MWID10050600037503200000
MWID10100600037502840000
MWID10150600037502520000
MWID10200600037503470000
MWID10250600037503670000
MWID10300600037503720000
MWID10400600037504090000
MWID10500600037504490000
MPAR10050600037502150030
MPAR10100600037501860028
MPAR10150600037502670033
MPAR10200600037503380035
MPAR10250600037504020027
MPAR10300600037504460032
MPAR10400600037504720004
:     A=10.0,     H=8.0
MWID10050800025003220081
MWID10100800025003910065
MWID10150800025004100021
MWID10200800025004300030
MWID10250800025004490030
MWID10300800025004640033
MWID10400800025004880033
MWID10500800025005070032

----5----0----5----0----5----0----5----0----5----0----5----0----5----0----5----0
         1         2         3         4         5         6         7         8
```

Appendix G (Continued)

```
        1         2         3         4         5         6         7         8
----5----0----5----0----5----0----5----0----5----0----5----0----5----0----5----0

MPAR10050800025003190062
MPAR10100800025003540085
MPAR10150800025004260054
MPAR10200800025004950038
MPAR10250800025005410040
MPAR10300800025005670043
MPAR10400800025006230065
MPAR10500800025006780074
:
MPAR10050800037501630026
MPAR10100800037501970037
MPAR10150800037502210062
MPAR10200800037502440080
MPAR10250800037502590094
MPAR10300800037502730106
MPAR10400800037502490068
MPAR10500800037502660071
:     A=10.0,     H=10.0
MWID10051000025002780083
MWID10101000025003220081
MWID10151000025003600097
MWID10201000025003540104
MWID10251000025003520126
MWID10301000025002710000
MWID10401000025002970000
MWID10501000025003210000
MPAR10051000025002380020
MPAR10101000025003120051
MPAR10151000025003980073
MPAR10201000025004640063
MPAR10251000025004960070
MPAR10301000025005230075
MPAR10401000025005360058
MPAR10501000025005490037
:
MWID10051000037504170039
MWID10101000037504110096
MWID10151000037503820047
MWID10201000037504150042
MWID10251000037504320039
MWID10301000037504490038
MWID10401000037504680037
MWID10501000037504830040
MPAR10051000037502260053
MPAR10101000037502570052
MPAR10151000037503160057
MPAR10201000037503750040
MPAR10251000037504040033
MPAR10301000037504240028
:     A=20.0,     H=3.5

----5----0----5----0----5----0----5----0----5----0----5----0----5----0----5----0
        1         2         3         4         5         6         7         8
```

Appendix G (Continued)

```
        1         2         3         4         5         6         7         8
----5----0----5----0----5----0----5----0----5----0----5----0----5----0----5----0

MWID20050350025000550004
MWID20100350025001190016
MWID20150350025001750045
MWID20200350025002270048
MWID20250350025002550043
MWID20300350025002850043
MWID20400350025003050026
MWID20500350025003260020
MPAR20050350025000450004
MPAR20100350025000960016
MPAR20150350025001520040
MPAR20200350025002290060
MPAR20250350025002450000
MPAR20300350025002890000
:
MPAR20050350037500430009
MPAR20100350037501120018
MPAR20150350037501730025
MPAR20200350037502210029
MPAR20250350037502710036
MPAR20300350037503040041
MPAR20400350037503090006
MPAR20500350037503490003
:     A=20.0,     H=4.0
MWID20050400025000670003
MWID20100400025000910004
MWID20150400025001440009
MWID20200400025001990010
MWID20250400025002450008
MWID20300400025002700007
MWID20400400025003210003
MPAR20050400025000610012
MPAR20100400025001300035
MPAR20150400025001840037
MPAR20200400025002500048
MPAR20250400025002720030
MPAR20300400025003020040
MPAR20400400025003180000
MPAR20500400025003550000
:
MPAR20050400037500590011
MPAR20100400037501110018
MPAR20150400037501700034
MPAR20200400037502200044
MPAR20250400037502480056
MPAR20300400037502760063
MPAR20400400037503190071
MPAR20500400037502990072
:     A=20.0,     H=6.0
MWID20050600025000810001

----5----0----5----0----5----0----5----0----5----0----5----0----5----0----5----0
        1         2         3         4         5         6         7         8
```

Appendix G (Continued)

```
         1         2         3         4         5         6         7         8
----5----0----5----0----5----0----5----0----5----0----5----0----5----0----5----0

MWID20100600025000990024
MWID20150600025001320025
MWID20200600025001560030
MWID2025060002500175003 3
MWID2030060002500190003 4
MWID2040060002500204002 4
MWID2050060002500215000 5
MPAR2005060002500085001 2
MPAR2010060002500136003 1
MPAR2015060002500202005 3
MPAR2020060002500267005 3
MPAR2025060002500330006 4
MPAR2030060002500378005 9
MPAR2040060002500424004 7
MPAR2050060002500446004 6
:
MPAR2005060003750060000 3
MPAR2010060003750121001 0
MPAR2015060003750166001 9
MPAR2020060003750224002 3
MPAR2025060003750258002 4
MPAR2030060003750291002 7
MPAR2040060003750350003 1
MPAR2050060003750382002 4
:     A=20.0,    H=8.0
MWID2005080002500041000 8
MWID2010080002500062000 6
MWID2015080002500083000 7
MWID2020080002500099000 6
MWID2025080002500114000 6
MWID2030080002500127000 6
MPAR2005080002500056002 6
MPAR2010080002500206003 1
MPAR2015080002500299005 2
MPAR2020080002500332006 5
MPAR2025080002500325002 7
MPAR2030080002500345002 6
MPAR2040080002500354000 0
:
MWID2005080003750068000 5
MWID2010080003750142001 7
MWID2015080003750196004 7
MWID2020080003750232006 3
MWID2025080003750260007 0
MWID2030080003750280007 0
MWID2040080003750275000 0
MPAR2005080003750059000 4
MPAR2010080003750116000 7
MPAR2015080003750187001 0
MPAR2020080003750254000 9

----5----0----5----0----5----0----5----0----5----0----5----0----5----0----5----0
         1         2         3         4         5         6         7         8
```

Appendix G (Continued)

```
         1         2         3         4         5         6         7         8
----5----0----5----0----5----0----5----0----5----0----5----0----5----0----5----0

:     A=20.0,    H=10.0
MWID2005100002500031000 3
MWID2010100002500053000 3
MWID2015100002500072000 4
MWID2020100002500087000 5
MWID2025100002500100000 5
MWID2030100002500109000 1
MPAR2005100002500075001 8
MPAR2010100002500212003 5
MPAR2015100002500246004 4
MPAR2020100002500270004 2
MPAR2025100002500239000 0
MPAR2030100002500250000 0
MPAR2040100002500267000 0
:
MWID2005100003750071001 8
MWID2010100003750154006 0
MWID2015100003750187004 3
MWID2020100003750209005 1
MWID2025100003750205003 8
MWID2030100003750216003 9
MWID2040100003750245003 9
MWID2050100003750223000 0
MPAR2005100003750061001 1
MPAR2010100003750105003 1
MPAR2015100003750108000 1
MPAR2020100003750121000 0
MPAR2025100003750133000 0
MPAR2030100003750144000 0
:     A=30.0,    H=3.5
MWID3005035002500023000 3
MWID3010035002500055000 2
MWID3015035002500066000 3
MWID3020035002500100000 5
MWID3025035002500116000 7
MWID3030035002500143000 7
MWID3040035002500175000 5
MWID3050035002500203000 5
MPAR3005035002500029000 3
MPAR3010035002500065000 4
MPAR3015035002500119000 5
MPAR3020035002500170000 6
MPAR3025035002500212000 8
MPAR3030035002500230000 0
MOAK3005035002500028000 7
MOAK3010035002500039000 4
MOAK3015035002500057000 5
MOAK3020035002500075000 7
MOAK3025035002500088000 7
MOAK3030035002500099000 6

----5----0----5----0----5----0----5----0----5----0----5----0----5----0----5----0
         1         2         3         4         5         6         7         8
```

Appendix G (Continued)

```
        1         2         3         4         5         6         7         8
----5----0----5----0----5----0----5----0----5----0----5----0----5----0----5----0

MOAK30400350025001220006
MOAK30500350025001440007
:
MWID30050350037500220009
MWID30100350037500550007
MWID30150350037500880005
MWID30200350037501240005
MWID30250350037501510006
MWID30300350037501600010
MWID30400350037501980011
MWID30500350037502170000
MPAR30050350037500440011
MPAR30100350037500810009
MPAR30150350037501170010
MPAR30200350037501510009
MOAK30050350037500300001
MOAK30100350037500520005
MOAK30150350037500760009
MOAK30200350037501010009
MOAK30250350037501220011
MOAK30300350037501270004
:     A=30.0,    H=4.0
MWID30050400025000260004
MWID30100400025000550003
MWID30150400025000840007
MWID30200400025001120009
MWID30250400025001310009
MWID30300400025001490006
MWID30400400025001800006
MWID30500400025002070005
MPAR30050400025000180010
MPAR30100400025000570014
MPAR30150400025000930017
MPAR30200400025001310022
MPAR30250400025001560024
MPAR30300400025001730028
MPAR30400400025002020033
MPAR30500400025002270038
MOAK30050400025000290005
MOAK30100400025000440005
MOAK30150400025000570004
MOAK30200400025000710004
MOAK30250400025000840004
MOAK30300400025000970004
MOAK30400400025001200005
MOAK30500400025001410005
:
MWID30050400037500230012
MWID30100400037500520012
MWID30150400037500790021

----5----0----5----0----5----0----5----0----5----0----5----0----5----0----5----0
         1         2         3         4         5         6         7         8
```

Appendix G (Continued)

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        1         2         3         4         5         6         7         8
----5----0----5----0----5----0----5----0----5----0----5----0----5----0----5----0

MWID30200400037501050028
MWID30250400037501240033
MWID30300400037501410037
MWID30400400037501460029
MWID30500400037501550014
MPAR30050400037500330008
MPAR30100400037500810011
MPAR30150400037501220015
MPAR30200400037501470016
MPAR30250400037501490000
MOAK30050400037500260008
MOAK30100400037500570017
MOAK30150400037500810021
MOAK30200400037500960021
MOAK30250400037501110021
MOAK30300400037501210020
MOAK30400400037501200000
:     A=30.0,    H=6.0
MWID30050600025000360030
MWID30100600025000540034
MWID30150600025000740046
MWID30200600025000660021
MWID30250600025000760025
MWID30300600025000860030
MWID30400600025001050039
MWID30500600025001020049
MPAR30050600025000370005
MPAR30100600025000730010
MPAR30150600025001050014
MPAR30200600025001490020
MPAR30250600025001930025
MPAR30300600025002280026
MPAR30400600025002700022
MPAR30500600025002910021
MOAK30050600025000240006
MOAK30100600025000440010
MOAK30150600025000570010
MOAK30200600025000690011
MOAK30250600025000790009
MOAK30300600025000900009
MOAK30400600025001090009
MOAK30500600025001270009
:
MWID30050600037500230011
MWID30100600037500320004
MWID30150600037500510005
MWID30200600037500630008
MWID30250600037500760008
MWID30300600037500880008
MWID30400600037501090011

----5----0----5----0----5----0----5----0----5----0----5----0----5----0----5----0
         1         2         3         4         5         6         7         8
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Appendix G (Continued)

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        1         2         3         4         5         6         7         8
----5----0----5----0----5----0----5----0----5----0----5----0----5----0----5----0

MWID30500600037501280016
MPAR30050600037500330010
MPAR30100600037500680004
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MPAR30200600037501090008
MPAR30250600037501210009
MPAR30300600037501320009
MOAK30050600037500180001
MOAK30100600037500360002
MOAK30150600037500520003
MOAK30200600037500650003
MOAK30250600037500770004
MOAK30300600037500880004
MOAK30400600037501100004
MOAK30500600037501300004
:     A=30.0,     H=8.0
MWID30050800025000160002
MWID30100800025000380006
MWID30150800025000500005
MWID30200800025000630005
MWID30250800025000740005
MWID30300800025000850005
MWID30400800025001050004
MPAR30050800025000170006
MPAR30100800025000820012
MPAR30150800025001240016
MPAR30200800025001400016
MPAR30250800025001530015
MPAR30300800025001630015
MPAR30400800025001760006
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MOAK30100800025000300004
MOAK30150800025000410004
MOAK30200800025000510004
MOAK30250800025000610004
MOAK30300800025000700005
MOAK30400800025000850005
MOAK30500800025001000006
:
MWID30050800037500330006
MWID30100800037500450009
MWID30150800037500590011
MWID30200800037500710013
MWID30250800037500820015
MWID30300800037500930017
MWID30400800037501100023
MWID30500800037501290028
MPAR30050800037500220006
MPAR30100800037500390006
MPAR30150800037500550008

----5----0----5----0----5----0----5----0----5----0----5----0----5----0----5----0
         1         2         3         4         5         6         7         8
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Appendix G (Continued)

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        1         2         3         4         5         6         7         8
----5----0----5----0----5----0----5----0----5----0----5----0----5----0----5----0

MPAR30200800037500680010
MPAR30250800037500800013
MPAR30300800037500920016
MPAR30400800037501030001
MPAR30500800037501210001
MOAK30050800037500210004
MOAK30100800037500320002
MOAK30150800037500470002
MOAK30200800037500590002
MOAK30250800037500700002
MOAK30300800037500800002
MOAK30400800037500990002
MOAK30500800037501160001
:     A=30.0,     H=10.0
MWID30051000025000110003
MWID30101000025000260003
MWID30151000025000390004
MWID30201000025000510005
MWID30251000025000620006
MWID30301000025000710006
MWID30401000025000870004
MPAR30051000025000160002
MPAR30101000025000530009
MPAR30151000025000720009
MPAR30201000025000850008
MPAR30251000025000950014
MPAR30301000025001150000
MPAR30401000025001320000
MPAR30501000025001480000
MOAK30051000025000160007
MOAK30101000025000280006
MOAK30151000025000390006
MOAK30201000025000500006
MOAK30251000025000590006
MOAK30301000025000680007
MOAK30401000025000810005
MOAK30501000025000910004
:
MWID30051000037500250004
MWID30101000037500330009
MWID30151000037500420012
MWID30201000037500520016
MWID30251000037500630020
MWID30301000037500710024
MWID30401000037500900033
MWID30501000037500900018
MPAR30051000037500160006
MPAR30101000037500290006
MPAR30151000037500420008
MPAR30201000037500540010

----5----0----5----0----5----0----5----0----5----0----5----0----5----0----5----0
         1         2         3         4         5         6         7         8
```

Appendix G (Continued)

```
        1         2         3         4         5         6         7         8
----5----0----5----0----5----0----5----0----5----0----5----0----5----0----5----0

MPAR30251000037500650011
MPAR30301000037500750013
MPAR30401000037500830000
MPAR30501000037500990000
MOAK30051000037500200005
MOAK30101000037500330006
MOAK30151000037500440006
MOAK30201000037500550006
MOAK30251000037500640005
MOAK30301000037500700001
MOAK30401000037500870001
MOAK30501000037501020001
:     ORNL  DATA
:     A=0.0,    H=3.5
ORNL00050350123402570000
ORNL00100350123407000000
ORNL00150350123411140086
ORNL00200350123414430000
ORNL00250350123417860000
ORNL00300350123420570086
ORNL00350350123423570000
:     A=0.0,    H=4.0
ORNL00050400123401710000
ORNL00100400123404000000
ORNL00150400123408570000
ORNL00200400123412570000
ORNL00250400123415290129
ORNL00300400123417000000
ORNL00350400123418430100
ORNL00400400123419790000
ORNL00450400123421140000
:     A=0.0,    H=6.0
ORNL00050600123404140000
ORNL00100600123409000143
ORNL00150600123411710000
ORNL00200600123413430000
ORNL00250600123415140000
ORNL00300600123416140000
ORNL00350600123417140000
ORNL00400600123418140129
ORNL00450600123419140000
:     A=0.0,    H=8.0
ORNL00050800123403000000
ORNL00100800123405570000
ORNL00150800123407430000
ORNL00200800123409430171
ORNL00250800123411000000
ORNL00300800123412000000
ORNL00350800123413000000
ORNL00400800123413710129

----5----0----5----0----5----0----5----0----5----0----5----0----5----0----5----0
         1         2         3         4         5         6         7         8
```

Appendix G (Continued)

```
        1         2         3         4         5         6         7         8
----5----0----5----0----5----0----5----0----5----0----5----0----5----0----5----0

ORNL00450800123414290000
:     A=0.0,    H=9.0
ORNL00050900123406000000
ORNL00100900123408570000
ORNL00150900123409860000
ORNL00200900123410710000
ORNL00250900123411570079
ORNL00300900123412000000
ORNL00350900123412570000
ORNL00400900123413000000
ORNL00450900123413500071
ORNL00500900123414000000
:     A=10.0,   H=4.0
ORNL10050400123404140000
ORNL10100400123407430000
ORNL10150400123411000157
ORNL10200400123413430000
ORNL10250400123415430000
ORNL10300400123417000186
ORNL10350400123418000000
ORNL10400400123418860000
ORNL10450400123419570000
ORNL10500400123420140329
ORNL10550400123420720000
:     A=10.0,   H=6.0
ORNL10050600123404710000
ORNL10100600123409000000
ORNL10150600123412290000
ORNL10200600123414140000
ORNL10250600123415430186
ORNL10300600123416430000
ORNL10350600123417290000
:     A=10.0,   H=8.0
ORNL10050800123404140000
ORNL10100800123407430000
ORNL10150800123409000000
ORNL10200800123410000000
ORNL10250800123411290000
ORNL10300800123412290086
ORNL10350800123413430071
ORNL10400800123414710000
ORNL10450800123416000086
ORNL10500800123417250000
:     A=10.0,   H=10.0
ORNL10051000123404710000
ORNL10101000123407860000
ORNL10151000123409290000
ORNL10201000123410000221
ORNL10251000123410710000
ORNL10301000123411290000

----5----0----5----0----5----0----5----0----5----0----5----0----5----0----5----0
         1         2         3         4         5         6         7         8
```

Appendix G (Continued)

```
         1         2         3         4         5         6         7         8
----5----0----5----0----5----0----5----0----5----0----5----0----5----0----5----0

ORNL103510001234120002 71
```

```
ORNL10351000123412000271
ORNL10401000123412430000
ORNL10451000123413000000
ORNL10501000123413570000
:     A=20.0,    H=4.0
ORNL20050400123401480000
ORNL20100400123402290000
ORNL20150400123402810000
ORNL20200400123403330095
ORNL20250400123403760000
ORNL20300400123404190000
ORNL20350400123404480000
ORNL20400400123404740086
ORNL20450400123405000000
ORNL20500400123405290000
ORNL20550400123405530000
ORNL20600400123405760100
ORNL20650400123405900000
:     A=20.0,    H=6.0
ORNL20050600123401000000
ORNL20100600123401710000
ORNL20150600123402240000
ORNL20200600123402670000
ORNL20250600123403000000
ORNL20300600123403290043
ORNL20350600123403450000
ORNL20400600123403610000
ORNL20450600123403760000
ORNL20500600123403860029
ORNL20550600123403900000
ORNL20600600123403950000
ORNL20650600123404000000
:     A=20.0,    H=8.0
ORNL20050800123401000000
ORNL20100800123401710000
ORNL20150800123402240000
ORNL20200800123402570000
ORNL20250800123402790019
ORNL20300800123403000000
ORNL20350800123403140000
ORNL20400800123403290000
ORNL20450800123403410000
ORNL20500800123403520000
ORNL20550800123403600024
ORNL20600800123403670000
ORNL20650800123403710000
:     A=20.0,    H=10.0
ORNL20051000123401290000
ORNL20101000123401860000
ORNL20151000123402190048

----5----0----5----0----5----0----5----0----5----0----5----0----5----0----5----0
         1         2         3         4         5         6         7         8
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Appendix G (Continued)

```
         1         2         3         4         5         6         7         8
----5----0----5----0----5----0----5----0----5----0----5----0----5----0----5----0

ORNL20201000123402480000
ORNL20251000123402670000
ORNL20301000123402760000
ORNL20351000123402860019
ORNL20401000123402960024
ORNL20451000123403040000
:     A=30.0,    H=4.0
ORNL30050400123400500000
ORNL30100400123401000000
ORNL30150400123401500000
ORNL30200400123402000038
ORNL30250400123402430000
ORNL30300400123402830033
ORNL30350400123403120000
ORNL30400400123403380019
ORNL30450400123403570000
:     A=30.0,    H=6.0
ORNL30050600123400500000
ORNL30100600123400880000
ORNL30150600123401240011
ORNL30200600123401570000
ORNL30250600123401880000
ORNL30300600123402140000
ORNL30350600123402380019
ORNL30400600123402600000
ORNL30450600123402790000
:     A=30.0,    H=8.0
ORNL30050800123400500000
ORNL30100800123400830000
ORNL30150800123401100000
ORNL30200800123401360019
ORNL30250800123401600000
ORNL30300800123401820029
ORNL30350800123402030000
ORNL30400800123402240026
ORNL30450800123402430000
:     A=30.0,    H=10.0
ORNL30051000123400360000
ORNL30101000123400600000
ORNL30151000123400790000
ORNL30201000123400980012
ORNL30251000123401120000
ORNL30301000123401250000
ORNL30351000123401380000
ORNL30401000123401500017
ORNL30451000123401610000
ORNL30501000123401720000
ORNL30551000123401830000
ORNL30601000123401940019
ORNL30651000123402030000

----5----0----5----0----5----0----5----0----5----0----5----0----5----0----5----0
         1         2         3         4         5         6         7         8
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Appendix G (Continued)

```
         1         2         3         4         5         6         7         8
----5----0----5----0----5----0----5----0----5----0----5----0----5----0----5----0

:     A=40.0,    H=4.0
ORNL40050400123400310000
ORNL40100400123400690000
ORNL40150400123401140000
ORNL40200400123401500017
ORNL40250400123401830000
ORNL40300400123402140019
ORNL40350400123402480000
ORNL40400400123402740029
ORNL40450400123402940000
ORNL40500400123403140000
:     A=40.0,    H=6.0
ORNL40050600123400240000
ORNL40100600123400500000
ORNL40150600123400790000
ORNL40200600123401050010
ORNL40250600123401260017
ORNL40300600123401450000
ORNL40350600123401640000
ORNL40400600123401790029
ORNL40450600123401880021
ORNL40500600123401930000
ORNL40550600123401980000
ORNL40600600123402020000
ORNL40650600123402050000
:     A=40.0,    H=8.0
ORNL40050800123400240000
ORNL40100800123400500000
ORNL40150800123400760000
ORNL40200800123400980007
ORNL40250800123401190017
ORNL40300800123401380000
ORNL40350800123401570000
ORNL40400800123401710019
ORNL40450800123401830031
ORNL40500800123401880000
ORNL40550800123401930000
ORNL40600800123401960000
ORNL40650800123401980000
:     A=40.0,    H=10.0
ORNL40051000123400190000
ORNL40101000123400400000
ORNL40151000123400600000
ORNL40201000123400790000
ORNL40251000123400950000
ORNL40301000123401100000
ORNL40351000123401240021
ORNL40401000123401310000
ORNL40451000123401380000
ORNL40501000123401430000

----5----0----5----0----5----0----5----0----5----0----5----0----5----0----5----0
         1         2         3         4         5         6         7         8
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Appendix G (Continued)

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         1         2         3         4         5         6         7         8
----5----0----5----0----5----0----5----0----5----0----5----0----5----0----5----0

ORNL40551000123401460000
ORNL40601000123401480029
ORNL40651000123401500000
:      MEAN  DATA
:      A=0.0,    H=3.5
MEAN00050350123403720072
MEAN00100350123405640072
MEAN00150350123406960072
MEAN00200350123407860060
MEAN00250350123408760084
MEAN00300350123409360096
MEAN00350350123409860000
MEAN00400350123410320048
MEAN00450350123410680000
MEAN00500350123410920000
:      A=0.0,    H=4.0
MEAN00050400123403600144
MEAN00100400123405520084
MEAN00150400123406480084
MEAN00200400123407320072
MEAN00250400123408040072
MEAN00300400123408760048
MEAN00350400123409360000
MEAN00400400123409960060
MEAN00450400123410440000
MEAN00500400123410880000
:      A=0.0,    H=6.0
MEAN00050600123404440216
MEAN00100600123405520108
MEAN00150600123406480084
MEAN00200600123407200108
MEAN00250600123407860096
MEAN00300600123408520060
MEAN00350600123409100000
MEAN00400600123409600091
MEAN00450600123410080000
MEAN00500600123410440048
:      A=0.0,    H=8.0
MEAN00050800123404440108
MEAN00100800123406000072
MEAN00150800123406840060
MEAN00200800123407320072
MEAN00250800123407740066
MEAN00300800123408160072
MEAN00350800123408400000
MEAN00400800123408640060
MEAN00450800123408820000
MEAN00500800123409000000
:      A=0.0,    H=10.0
MEAN00051000123403960120

----5----0----5----0----5----0----5----0----5----0----5----0----5----0----5----0
         1         2         3         4         5         6         7         8
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Appendix G (Continued)

```
         1         2         3         4         5         6         7         8
----5----0----5----0----5----0----5----0----5----0----5----0----5----0----5----0

MEAN00101000123405040132
MEAN00151000123405760138
MEAN00201000123406430108
MEAN00251000123406840108
MEAN00301000123407200180
MEAN00351000123407560000
:       A=10.0,   H=3.5
MEAN10050350123402400050
MEAN10100350123403360036
MEAN10150350123404080048
MEAN10200350123404740120
MEAN10250350123405400108
MEAN10300350123406000120
MEAN10350350123406480000
MEAN10400350123406960132
MEAN10450350123407440000
MEAN10500350123407920228
:       A=10.0,   H=4.0
MEAN10050400123403100078
MEAN10100400123403960084
MEAN10150400123404360096
MEAN10200400123404760077
MEAN10250400123405160120
MEAN10300400123405400096
MEAN10350400123405600000
MEAN10400400123405780084
MEAN10450400123405900000
MEAN10500400123405970072
:       A=10.0,   H=6.0
MEAN10050600123401800000
MEAN10100600123402520045
MEAN10150600123403000040
MEAN10200600123403440040
MEAN10250600123403770036
MEAN10300600123404080040
MEAN10350600123404250000
MEAN10400600123404440036
MEAN10450600123404560000
MEAN10500600123404600040
:       A=10.0,   H=8.0
MEAN10050800123402400078
MEAN10100800123403000096
MEAN10150800123403600090
MEAN10200800123403960108
MEAN10250800123404330140
MEAN10300800123404680096
MEAN10350800123404920000
MEAN10400800123405100108
MEAN10450800123405250000
MEAN10500800123405400144

----5----0----5----0----5----0----5----0----5----0----5----0----5----0----5----0
         1         2         3         4         5         6         7         8
```

Appendix G (Continued)

```
         1         2         3         4         5         6         7         8
----5----0----5----0----5----0----5----0----5----0----5----0----5----0----5----0

:       A=10.0,   H=10.0
MEAN10051000123402520024
MEAN10101000123403240072
MEAN10151000123403650040
MEAN10201000123403980040
MEAN10251000123404300040
MEAN10301000123404650036
MEAN10351000123404870000
MEAN10401000123405040036
MEAN10451000123405160000
MEAN10501000123405200036
:       A=20.0,   H=3.5
MEAN20050350123400480012
MEAN20100350123401000008
MEAN20150350123401600012
MEAN20200350123402160000
MEAN20250350123402520012
MEAN20300350123402800012
MEAN20350350123403020000
MEAN20400350123403180000
MEAN20450350123403280000
MEAN20500350123403360000
MEAN20550350123403420000
:       A=20.0,   H=4.0
MEAN20050400123400520008
MEAN20100400123401000020
MEAN20150400123401560020
MEAN20200400123402120021
MEAN20250400123402480016
MEAN20300400123402760024
MEAN20350400123402970000
MEAN20400400123403080000
MEAN20450400123403160000
MEAN20500400123403240000
:       A=20.0,   H=6.0
MEAN20050600123400560013
MEAN20100600123401120016
MEAN20150600123401600032
MEAN20200600123402100048
MEAN20250600123402560078
MEAN20300600123402960076
MEAN20350600123403240000
MEAN20400600123403520068
MEAN20450600123403640000
MEAN20500600123403760000
:       A=20.0,   H=8.0
MEAN20050800123400600012
MEAN20100800123401160075
MEAN20150800123401720104
MEAN20200800123402200152

----5----0----5----0----5----0----5----0----5----0----5----0----5----0----5----0
         1         2         3         4         5         6         7         8
```

Appendix G (Continued)

```
         1         2         3         4         5         6         7         8
----5----0----5----0----5----0----5----0----5----0----5----0----5----0----5----0

MEAN20250800123402560108
MEAN20300800123402840060
MEAN20350800123403000044
MEAN20400800123403120040
:      A=20.0,  H=10.0
MEAN20051000123400640020
MEAN20101000123401120064
MEAN20151000123401480068
MEAN20201000123401720090
MEAN20251000123401880052
MEAN20301000123402040048
MEAN20351000123402120000
MEAN20401000123402200000
:      A=30.0,   H=3.5
MEAN30050350123400330009
MEAN30100350123400620019
MEAN30150350123400860020
MEAN30200350123401100032
MEAN30250350123401320044
MEAN30300350123401500056
MEAN30350350123401660000
MEAN30400350123401780018
MEAN30450350123401840000
MEAN30500350123401880028
:      A=30.0,   H=4.0
MEAN30050400123400320010
MEAN30100400123400590020
MEAN30150400123400820034
MEAN30200400123401040033
MEAN30250400123401240034
MEAN30300400123401400039
MEAN30350400123401540000
MEAN30400400123401640044
MEAN30450400123401740000
MEAN30500400123401780044
:      A=30.0,   H=6.0
MEAN30050600123400240012
MEAN30100600123400450024
MEAN30150600123400640025
MEAN30200600123400820042
MEAN30250600123400960014
MEAN30300600123401100020
MEAN30350600123401200000
MEAN30400600123401280026
MEAN30450600123401320000
MEAN30500600123401360032
:      A=30.0,   H=8.0
MEAN30050800123400260014
MEAN30100800123400440012
MEAN30150800123400600018

----5----0----5----0----5----0----5----0----5----0----5----0----5----0----5----0
         1         2         3         4         5         6         7         8
```

Appendix G (Continued)

```
         1         2         3         4         5         6         7         8
----5----0----5----0----5----0----5----0----5----0----5----0----5----0----5----0

MEAN30200800123400720020
MEAN30250800123400820026
MEAN30300800123400920024
MEAN30350800123401000000
MEAN30400800123401080020
MEAN30450800123401120000
MEAN30500800123401160014
:      A=30.0,  H=10.0
MEAN30051000123400200008
MEAN30101000123400360010
MEAN30151000123400500008
MEAN30201000123400600010
MEAN30251000123400700012
MEAN30301000123400780018
MEAN30351000123400850000
MEAN30401000123400920020
MEAN30451000123400980000
MEAN30501000123401020012
:      MHIG  DATA
:      A=0.0,    H=3.5
MHIG00050350123404680000
MHIG00100350123406480000
MHIG00150350123407680000
MHIG00200350123408590000
MHIG00250350123409480000
MHIG00300350123410320000
MHIG00350350123410800000
MHIG00400350123411240000
MHIG00450350123411640000
MHIG00500350123412000000
:      A=0.0,    H=4.0
MHIG00050400123405160000
MHIG00100400123406360000
MHIG00150400123407320000
MHIG00200400123408160000
MHIG00250400123408880000
MHIG00300400123409480000
MHIG00350400123410080000
MHIG00400400123410680000
MHIG00450400123411160000
MHIG00500400123411640000
:      A=0.0,    H=6.0
MHIG00050600123405880000
MHIG00100600123406840000
MHIG00150600123407560000
MHIG00200600123408280000
MHIG00250600123408880000
MHIG00300600123409480000
MHIG00350600123410080000
MHIG00400600123410660000

----5----0----5----0----5----0----5----0----5----0----5----0----5----0----5----0
         1         2         3         4         5         6         7         8
```

Appendix G (Continued)

```
         1         2         3         4         5         6         7         8
----5----0----5----0----5----0----5----0----5----0----5----0----5----0----5----0

MHIG004506001234112400000
MHIG005006001234115200000
:        A=0.0,     H=8.0
MHIG000508001234054000000
MHIG001008001234067200000
MHIG001508001234077300000
MHIG002008001234081900000
MHIG002508001234086400000
MHIG003008001234088800000
MHIG003508001234091200000
MHIG004008001234093600000
MHIG004508001234096000000
MHIG005008001234097600000
:        A=0.0,    H=10.0
MHIG000510001234051600000
MHIG001010001234064800000
MHIG001510001234072000000
MHIG002010001234079200000
MHIG002510001234085200000
MHIG003010001234091200000
MHIG003510001234094800000
:        A=10.0,    H=3.5
MHIG100503501234034800000
MHIG101003501234048000000
MHIG101503501234058800000
MHIG102003501234066000000
MHIG102503501234072600000
MHIG103003501234079200000
MHIG103503501234085400000
MHIG104003501234091500000
MHIG104503501234097200000
MHIG105003501234100800000
:        A=10.0,    H=4.0
MHIG100504001234039600000
MHIG101004001234049200000
MHIG101504001234055200000
MHIG102004001234060000000
MHIG102504001234063400000
MHIG103004001234066700000
MHIG103504001234068400000
MHIG104004001234069600000
MHIG104504001234070800000
MHIG105004001234072000000
:        A=10.0,    H=6.0
MHIG100506001234032000000
MHIG101006001234037200000
MHIG101506001234042000000
MHIG102006001234044600000
MHIG102506001234047200000
MHIG103006001234049900000

----5----0----5----0----5----0----5----0----5----0----5----0----5----0----5----0
         1         2         3         4         5         6         7         8
```

Appendix G (Continued)

```
         1         2         3         4         5         6         7         8
----5----0----5----0----5----0----5----0----5----0----5----0----5----0----5----0

MHIG103506001234052400000
MHIG104006001234054000000
MHIG104506001234055200000
MHIG105006001234056400000
:        A=10.0,    H=8.0
MHIG100508001234032900000
MHIG101008001234040300000
MHIG101508001234046800000
MHIG102008001234050000000
MHIG102508001234053000000
MHIG103008001234056000000
MHIG103508001234059000000
MHIG104008001234062000000
MHIG104508001234064800000
MHIG105008001234066700000
:        A=10.0,   H=10.0
MHIG100510001234040800000
MHIG101010001234045600000
MHIG101510001234049200000
MHIG102010001234052500000
MHIG102510001234055000000
MHIG103010001234057500000
MHIG103510001234058600000
MHIG104010001234059400000
MHIG104510001234060000000
MHIG105010001234060300000
:        A=20.0,    H=3.5
MHIG200503501234006800000
MHIG201003501234012400000
MHIG201503501234018000000
MHIG202003501234023600000
MHIG202503501234028000000
MHIG203003501234030800000
MHIG203503501234032400000
MHIG204003501234034000000
MHIG204503501234034800000
MHIG205003501234035600000
MHIG205503501234036000000
:        A=20.0,    H=4.0
MHIG200504001234006800000
MHIG201004001234013600000
MHIG201504001234019200000
MHIG202004001234024800000
MHIG202504001234028000000
MHIG203004001234030800000
MHIG203504001234032400000
MHIG204004001234034000000
MHIG204504001234034800000
MHIG205004001234035600000
:        A=20.0,    H=6.0

----5----0----5----0----5----0----5----0----5----0----5----0----5----0----5----0
         1         2         3         4         5         6         7         8
```

Appendix G (Continued)

```
         1         2         3         4         5         6         7         8
----5----0----5----0----5----0----5----0----5----0----5----0----5----0----5----0

MHIG2005060012340088000
MHIG2010060012340148000
MHIG2015060012340200000
MHIG2020060012340260000
MHIG2025060012340320000
MHIG2030060012340372000
MHIG2035060012340400000
MHIG2040060012340424000
MHIG2045060012340440000
MHIG2050060012340452000
:      A=20.0,    H=8.0
MHIG2005080012340100000
MHIG2010080012340196000
MHIG2015080012340284000
MHIG2020080012340328000
MHIG2025080012340344000
MHIG2030080012340358000
MHIG2035080012340368000
MHIG2040080012340372000
:      A=20.0,  H=10.0
MHIG2005100012340100000
MHIG2010100012340200000
MHIG2015100012340252000
MHIG2020100012340276000
MHIG2025100012340287000
MHIG2030100012340296000
MHIG2035100012340300000
MHIG2040100012340302000
:      A=30.0,    H=3.5
MHIG3005035012340050000
MHIG3010035012340092000
MHIG3015035012340136000
MHIG3020035012340170000
MHIG3025035012340202000
MHIG3030035012340226000
MHIG3035035012340238000
MHIG3040035012340244000
MHIG3045035012340246000
MHIG3050035012340246000
:      A=30.0,    H=4.0
MHIG3005040012340050000
MHIG3010040012340086000
MHIG3015040012340116000
MHIG3020040012340136000
MHIG3025040012340154000
MHIG3030040012340172000
MHIG3035040012340188000
MHIG3040040012340204000
MHIG3045040012340214000
MHIG3050040012340222000

----5----0----5----0----5----0----5----0----5----0----5----0----5----0----5----0
         1         2         3         4         5         6         7         8
```

Appendix G (Continued)

```
         1         2         3         4         5         6         7         8
----5----0----5----0----5----0----5----0----5----0----5----0----5----0----5----0

:      A=30.0,    H=6.0
MHIG3005060012340044000
MHIG3010060012340078000
MHIG3015060012340116000
MHIG3020060012340150000
MHIG3025060012340188000
MHIG3030060012340222000
MHIG3035060012340246000
MHIG3040060012340264000
MHIG3045060012340282000
MHIG3050060012340292000
:      A=30.0,    H=8.0
MHIG3005080012340048000
MHIG3010080012340084000
MHIG3015080012340120000
MHIG3020080012340142000
MHIG3025080012340154000
MHIG3030080012340162000
MHIG3035080012340168000
MHIG3040080012340174000
MHIG3045080012340179000
MHIG3050080012340182000
:      A=30.0,  H=10.0
MHIG3005100012340036000
MHIG3010100012340056000
MHIG3015100012340074000
MHIG3020100012340088000
MHIG3025100012340098000
MHIG3030100012340108000
MHIG3035100012340117000
MHIG3040100012340126000
MHIG3045100012340134000
MHIG3050100012340142000
:      MLOW  DATA
:      A=0.0,     H=3.5
MLOW0005035012340300000
MLOW0010035012340456000
MLOW0015035012340576000
MLOW0020035012340684000
MLOW0025035012340768000
MLOW0030035012340822000
MLOW0035035012340876000
MLOW0040035012340924000
MLOW0045035012340964000
MLOW0050035012340996000
:      A=0.0,     H=4.0
MLOW0005040012340240000
MLOW0010040012340444000
MLOW0015040012340564000
MLOW0020040012340638000

----5----0----5----0----5----0----5----0----5----0----5----0----5----0----5----0
         1         2         3         4         5         6         7         8
```

Appendix G (Continued)

```
         1         2         3         4         5         6         7         8
----5----0----5----0----5----0----5----0----5----0----5----0----5----0----5----0

MLOW00250400123407080000
MLOW00300400123407680000
MLOW00350400123408280000
MLOW00400400123408900000
MLOW00450400123409480000
MLOW00500400123409960000
:       A=0.0,     H=6.0
MLOW00050600123403000000
MLOW00100600123404440000
MLOW00150600123405280000
MLOW00200600123406000000
MLOW00250600123406600000
MLOW00300600123407080000
MLOW00350600123407560000
MLOW00400600123408040000
MLOW00450600123408520000
MLOW00500600123409120000
:       A=0.0,     H=8.0
MLOW00050800123403000000
MLOW00100800123404440000
MLOW00150800123405520000
MLOW00200800123406120000
MLOW00250800123406480000
MLOW00300800123406840000
MLOW00350800123407140000
MLOW00400800123407440000
MLOW00450800123407670000
MLOW00500800123407900000
:       A=0.0,     H=10.0
MLOW00051000123402160000
MLOW00101000123403600000
MLOW00151000123404200000
MLOW00201000123404680000
MLOW00251000123404900000
MLOW00301000123405140000
MLOW00351000123405400000
:       A=10.0,    H=3.5
MLOW10050350123401200000
MLOW10100350123402160000
MLOW10150350123402760000
MLOW10200350123403360000
MLOW10250350123403960000
MLOW10300350123404320000
MLOW10350350123404680000
MLOW10400350123405000000
MLOW10450350123405300000
MLOW10500350123405520000
:       A=10.0,    H=4.0
MLOW10050400123401920000
MLOW10100400123402640000

----5----0----5----0----5----0----5----0----5----0----5----0----5----0----5----0
         1         2         3         4         5         6         7         8
```


Appendix G (Continued)

```
         1         2         3         4         5         6         7         8
----5----0----5----0----5----0----5----0----5----0----5----0----5----0----5----0

MLOW10150400123403240000
MLOW10200400123403720000
MLOW10250400123403960000
MLOW10300400123404130000
MLOW10350400123404300000
MLOW10400400123404470000
MLOW10450400123404640000
MLOW10500400123404800000
:       A=10.0,    H=6.0
MLOW10050600123400960000
MLOW10100600123401680000
MLOW10150600123402160000
MLOW10200600123402640000
MLOW10250600123403000000
MLOW10300600123403260000
MLOW10350600123403380000
MLOW10400600123403500000
MLOW10450600123403600000
MLOW10500600123403700000
:       A=10.0,    H=8.0
MLOW10050800123401080000
MLOW10100800123401920000
MLOW10150800123402400000
MLOW10200800123402520000
MLOW10250800123402600000
MLOW10300800123402670000
MLOW10350800123402730000
MLOW10400800123402780000
MLOW10450800123402830000
MLOW10500800123402880000
:       A=10.0,    H=10.0
MLOW10051000123401440000
MLOW10101000123402400000
MLOW10151000123403000000
MLOW10201000123403360000
MLOW10251000123403600000
MLOW10301000123403840000
MLOW10351000123404030000
MLOW10401000123404200000
MLOW10451000123404260000
MLOW10501000123404320000
:       A=20.0,    H=3.5
MLOW20050350123400240000
MLOW20100350123400640000
MLOW20150350123401240000
MLOW20200350123401840000
MLOW20250350123402280000
MLOW20300350123402520000
MLOW20350350123402720000
MLOW20400350123402920000

----5----0----5----0----5----0----5----0----5----0----5----0----5----0----5----0
         1         2         3         4         5         6         7         8
```

Appendix G (Continued)

```
         1         2         3         4         5         6         7         8
----5----0----5----0----5----0----5----0----5----0----5----0----5----0----5----0

MLOW204503501234030400000
MLOW205003501234031600000
MLOW205503501234032400000
:       A=20.0,    H=4.0
MLOW200504001234003200000
MLOW201004001234007400000
MLOW201504001234012000000
MLOW202004001234016800000
MLOW202504001234021000000
MLOW203004001234024800000
MLOW203504001234027200000
MLOW204004001234028400000
MLOW204504001234029200000
MLOW205004001234029600000
:       A=20.0,    H=6.0
MLOW200506001234004200000
MLOW201006001234008800000
MLOW201506001234012400000
MLOW202006001234014800000
MLOW202506001234016800000
MLOW203006001234018800000
MLOW203506001234020400000
MLOW204006001234021200000
MLOW204506001234022000000
MLOW205006001234022400000
:       A=20.0,    H=8.0
MLOW200508001234003200000
MLOW201008001234006000000
MLOW201508001234008000000
MLOW202008001234010000000
MLOW202508001234011500000
MLOW203008001234013000000
MLOW203508001234014400000
MLOW204008001234015600000
:       A=20.0,    H=10.0
MLOW200510001234002800000
MLOW201010001234005600000
MLOW201510001234007600000
MLOW202010001234008800000
MLOW202510001234010000000
MLOW203010001234011200000
MLOW203510001234012200000
MLOW204010001234012900000
:       A=30.0,    H=3.5
MLOW300503501234001800000
MLOW301003501234003600000
MLOW301503501234005100000
MLOW302003501234006600000
MLOW302503501234007800000
MLOW303003501234008900000

----5----0----5----0----5----0----5----0----5----0----5----0----5----0----5----0
         1         2         3         4         5         6         7         8
```

Appendix G (Continued)

```
         1         2         3         4         5         6         7         8
----5----0----5----0----5----0----5----0----5----0----5----0----5----0----5----0

MLOW303503501234010000000
MLOW304003501234010900000
MLOW304503501234011600000
MLOW305003501234012300000
:       A=30.0,    H=4.0
MLOW300504001234001600000
MLOW301004001234003200000
MLOW301504001234005000000
MLOW302004001234006400000
MLOW302504001234008000000
MLOW303004001234009400000
MLOW303504001234010600000
MLOW304004001234011600000
MLOW304504001234012600000
MLOW305004001234013500000
:       A=30.0,    H=6.0
MLOW300506001234001200000
MLOW301006001234002800000
MLOW301506001234004200000
MLOW302006001234005600000
MLOW302506001234006500000
MLOW303006001234007600000
MLOW303506001234008600000
MLOW304006001234009400000
MLOW304506001234010000000
MLOW305006001234010400000
:       A=30.0,    H=8.0
MLOW300508001234001200000
MLOW301008001234002600000
MLOW301508001234003800000
MLOW302008001234004800000
MLOW302508001234005600000
MLOW303008001234006400000
MLOW303508001234007200000
MLOW304008001234008000000
MLOW304508001234008600000
MLOW305008001234009000000
:       A=30.0,  H=10.0
MLOW300510001234001100000
MLOW301010001234002200000
MLOW301510001234003200000
MLOW302010001234004200000
MLOW302510001234005000000
MLOW303010001234005800000
MLOW303510001234006300000
MLOW304010001234006800000
MLOW304510001234007300000
MLOW305010001234007800000
:       DHIG  DATA
:       A=0.0,    H=3.5

----5----0----5----0----5----0----5----0----5----0----5----0----5----0----5----0
         1         2         3         4         5         6         7         8
```

Appendix G (Continued)

```
         1         2         3         4         5         6         7         8
----5----0----5----0----5----0----5----0----5----0----5----0----5----0----5----0

OHIG00050350123404200000
OHIG00100350123409000000
OHIG00150350123412720000
OHIG00200350123416200000
OHIG00250350123419200000
OHIG00300350123421840000
OHIG00350350123424480000
:       A=0.0,     H=4.0
OHIG00050400123402640000
OHIG00100400123405900000
OHIG00150400123410320000
OHIG00200400123414040000
OHIG00250400123416560000
OHIG00300400123418480000
OHIG00350400123419800000
OHIG00400400123421240000
OHIG00450400123422200000
:       A=0.0,     H=6.0
OHIG00050600123406000000
OHIG00100600123410440000
OHIG00150600123413080000
OHIG00200600123414640000
OHIG00250600123415960000
OHIG00300600123417160000
OHIG00350600123418280000
OHIG00400600123419320000
OHIG00450600123420160000
:       A=0.0,     H=8.0
OHIG00050800123404440000
OHIG00100800123406960000
OHIG00150800123409000000
OHIG00200800123410920000
OHIG00250800123412240000
OHIG00300800123413440000
OHIG00350800123414400000
OHIG00400800123415240000
OHIG00450800123415840000
:       A=0.0,     H=10.0
OHIG00051000123407440000
OHIG00101000123409840000
OHIG00151000123410920000
OHIG00201000123411760000
OHIG00251000123412480000
OHIG00301000123413200000
OHIG00351000123413740000
OHIG00401000123414280000
OHIG00451000123414760000
OHIG00501000123415080000
OHIG00551000123415360000
:       A=10.0,    H=4.0

----5----0----5----0----5----0----5----0----5----0----5----0----5----0----5----0
         1         2         3         4         5         6         7         8
```

Appendix G (Continued)

```
         1         2         3         4         5         6         7         8
----5----0----5----0----5----0----5----0----5----0----5----0----5----0----5----0

OHIG10050400123406000000
OHIG10100400123409960000
OHIG10150400123413080000
OHIG10200400123415000000
OHIG10250400123416920000
OHIG10300400123418480000
OHIG10350400123419500000
OHIG10400400123420520000
OHIG10450400123421360000
OHIG10500400123421960000
OHIG10550400123422320000
:       A=10.0,    H=6.0
OHIG10050600123407920000
OHIG10100600123412720000
OHIG10150600123415000000
OHIG10200600123416440000
OHIG10250600123417640000
OHIG10300600123418600000
OHIG10350600123419200000
:       A=10.0,    H=8.0
OHIG10050800123407920000
OHIG10100800123411160000
OHIG10150800123412720000
OHIG10200800123413920000
OHIG10250800123415100000
OHIG10300800123416150000
OHIG10350800123417150000
OHIG10400800123418150000
OHIG10450800123419190000
OHIG10500800123420230000
:       A=10.0,    H=10.0
OHIG10051000123406480000
OHIG10101000123409960000
OHIG10151000123411200000
OHIG10201000123412040000
OHIG10251000123412840000
OHIG10301000123413600000
OHIG10351000123414360000
OHIG10401000123415100000
OHIG10451000123415600000
OHIG10501000123416000000
:       A=20.0,    H=4.0
OHIG20050400123402400000
OHIG20100400123403240000
OHIG20150400123403800000
OHIG20200400123404320000
OHIG20250400123404760000
OHIG20300400123405160000
OHIG20350400123405460000
OHIG20400400123405720000

----5----0----5----0----5----0----5----0----5----0----5----0----5----0----5----0
         1         2         3         4         5         6         7         8
```

Appendix G (Continued)

```
         1         2         3         4         5         6         7         8
----5----0----5----0----5----0----5----0----5----0----5----0----5----0----5----0

0HIG2045040012340596000 0
0HIG205004001234062000000
0HIG205504001234064400000
0HIG206004001234066800000
:      A=20.0,     H=6.0
0HIG200506001234014000000
0HIG201006001234021200000
0HIG201506001234026400000
0HIG202006001234030400000
0HIG202506001234034400000
0HIG203006001234037200000
0HIG203506001234039200000
0HIG204006001234041000000
0HIG204506001234042000000
0HIG205006001234042800000
0HIG205506001234043600000
0HIG206006001234044400000
:      A=20.0,     H=8.0
0HIG200508001234017200000
0HIG201008001234023200000
0HIG201508001234026600000
0HIG202008001234029800000
0HIG202508001234032400000
0HIG203008001234034400000
0HIG203508001234036000000
0HIG204008001234037400000
0HIG204508001234038400000
0HIG205008001234039200000
0HIG205508001234040000000
0HIG206008001234040700000
0HIG206508001234041200000
:      A=20.0,     H=10.0
0HIG200510001234016400000
0HIG201010001234022400000
0HIG201510001234026000000
0HIG202010001234028400000
0HIG202510001234029800000
0HIG203010001234031000000
0HIG203510001234032100000
0HIG204010001234033200000
0HIG204510001234034200000
:      A=30.0,     H=4.0
0HIG300504001234007600000
0HIG301004001234013500000
0HIG301504001234019000000
0HIG302004001234024000000
0HIG302504001234028000000
0HIG303004001234031800000
0HIG303504001234034200000
0HIG304004001234036200000

----5----0----5----0----5----0----5----0----5----0----5----0----5----0----5----0
         1         2         3         4         5         6         7         8
```

Appendix G (Continued)

```
         1         2         3         4         5         6         7         8
----5----0----5----0----5----0----5----0----5----0----5----0----5----0----5----0

0HIG304504001234038000000
:      A=30.0,     H=6.0
0HIG300506001234007600000
0HIG301006001234011400000
0HIG301506001234014600000
0HIG302006001234017600000
0HIG302506001234020600000
0HIG303006001234023400000
0HIG303506001234025800000
0HIG304006001234027900000
0HIG304506001234029500000
:      A=30.0,     H=8.0
0HIG300508001234007000000
0HIG301008001234010800000
0HIG301508001234013600000
0HIG302008001234016000000
0HIG302508001234018200000
0HIG303008001234020600000
0HIG303508001234023000000
0HIG304008001234025000000
0HIG304508001234027000000
:      A=30.0,     H=10.0
0HIG300510001234005600000
0HIG301010001234008000000
0HIG301510001234010000000
0HIG302010001234012000000
0HIG302510001234013400000
0HIG303010001234014800000
0HIG303510001234016000000
0HIG304010001234017000000
0HIG304510001234018000000
0HIG305010001234019000000
0HIG305510001234020000000
0HIG306010001234021000000
0HIG306510001234022000000
:       OLOW  DATA
:       A=0.0,     H=3.5
0LOW000503501234019200000
0LOW001003501234051600000
0LOW001503501234094800000
0LOW002003501234129600000
0LOW002503501234159600000
0LOW003003501234189600000
0LOW003503501234219600000
:       A=0.0,     H=4.0
0LOW000504001234012000000
0LOW001004001234030000000
0LOW001504001234066000000
0LOW002004001234111600000
0LOW002504001234141600000

----5----0----5----0----5----0----5----0----5----0----5----0----5----0----5----0
         1         2         3         4         5         6         7         8
```

Appendix G (Continued)

```
         1         2         3         4         5         6         7         8
----5----0----5----0----5----0----5----0----5----0----5----0----5----0----5----0

0LOW0030040012341620000
0LOW0035040012341776000
0LOW0040040012341896000
0LOW0045040012342016000
:       A=0.0,     H=6.0
0LOW0005060012340252000
0LOW0010060012340696000
0LOW0015060012340996000
0LOW0020060012341162000
0LOW0025060012341332000
0LOW0030060012341476000
0LOW0035060012341596000
0LOW0040060012341692000
0LOW0045060012341776000
:       A=0.0,     H=8.0
0LOW0005080012340144000
0LOW0010080012340324000
0LOW0015080012340524000
0LOW0020080012340720000
0LOW0025080012340900000
0LOW0030080012341056000
0LOW0035080012341172000
0LOW0040080012341260000
0LOW0045080012341320000
:       A=0.0,     H=10.0
0LOW0005100012340492000
0LOW0010100012340720000
0LOW0015100012340888000
0LOW0020100012340984000
0LOW0025100012341056000
0LOW0030100012341128000
0LOW0035100012341173000
0LOW0040100012341218000
0LOW0045100012341260000
0LOW0050100012341296000
0LOW0055100012341328000
:      A=10.0,     H=4.0
0LOW1005040012340252000
0LOW1010040012340528000
0LOW1015040012340824000
0LOW1020040012341092000
0LOW1025040012341296000
0LOW1030040012341442000
0LOW1035040012341572000
0LOW1040040012341648000
0LOW1045040012341716000
0LOW1050040012341764000
0LOW1055040012341800000
:      A=10.0,     H=6.0
0LOW1005060012340216000

----5----0----5----0----5----0----5----0----5----0----5----0----5----0----5----0
         1         2         3         4         5         6         7         8
```

Appendix G (Continued)

```
         1         2         3         4         5         6         7         8
----5----0----5----0----5----0----5----0----5----0----5----0----5----0----5----0

0LOW1010060012340600000
0LOW1015060012340910000
0LOW1020060012341092000
0LOW1025060012341248000
0LOW1030060012341382000
0LOW1035060012341488000
:      A=10.0,     H=8.0
0LOW1005080012340216000
0LOW1010080012340420000
0LOW1015080012340600000
0LOW1020080012340732000
0LOW1025080012340840000
0LOW1030080012340936000
0LOW1035080012341032000
0LOW1040080012341128000
0LOW1045080012341224000
0LOW1050080012341320000
:      A=10.0,     H=10.0
0LOW1005100012340252000
0LOW1010100012340492000
0LOW1015100012340684000
0LOW1020100012340773000
0LOW1025100012340840000
0LOW1030100012340900000
0LOW1035100012340948000
0LOW1040100012340996000
0LOW1045100012341032000
0LOW1050100012341068000
:      A=20.0,     H=4.0
0LOW2005040012340064000
0LOW2010040012340124000
0LOW2015040012340182000
0LOW2020040012340232000
0LOW2025040012340276000
0LOW2030040012340312000
0LOW2035040012340344000
0LOW2040040012340372000
0LOW2045040012340400000
0LOW2050040012340428000
0LOW2055040012340455000
0LOW2060040012340482000
:      A=20.0,     H=6.0
0LOW2005060012340068000
0LOW2010060012340124000
0LOW2015060012340180000
0LOW2020060012340224000
0LOW2025060012340252000
0LOW2030060012340276000
0LOW2035060012340300000
0LOW2040060012340321000

----5----0----5----0----5----0----5----0----5----0----5----0----5----0----5----0
         1         2         3         4         5         6         7         8
```

Appendix G (Continued)

```
         1         2         3         4         5         6         7         8
----5----0----5----0----5----0----5----0----5----0----5----0----5----0----5----0

OLOW20450600123403380000
OLOW20500600123403500000
OLOW20550600123403600000
OLOW20600600123403680000
:     A=20.0,    H=8.0
OLOW20050800123400720000
OLOW20100800123401360000
OLOW20150800123401800000
OLOW20200800123402100000
OLOW20250800123402330000
OLOW20300800123402520000
OLOW20350800123402680000
OLOW20400800123402820000
OLOW20450800123402920000
OLOW20500800123403010000
OLOW20550800123403100000
OLOW20600800123403190000
OLOW20650800123403280000
:     A=20.0,    H=10.0
OLOW20051000123400800000
OLOW20101000123401480000
OLOW20151000123401880000
OLOW20201000123402160000
OLOW20251000123402320000
OLOW20301000123402440000
OLOW20351000123402540000
OLOW20401000123402640000
OLOW20451000123402720000
:     A=30.0,    H=4.0
OLOW30050400123400280000
OLOW30100400123400680000
OLOW30150400123401120000
OLOW30200400123401680000
OLOW30250400123402100000
OLOW30300400123402500000
OLOW30350400123402820000
OLOW30400400123403120000
OLOW30450400123403320000
:     A=30.0,    H=6.0
OLOW30050600123400320000
OLOW30100600123400640000
OLOW30150600123400940000
OLOW30200600123401240000
OLOW30250600123401530000
OLOW30300600123401820000
OLOW30350600123402100000
OLOW30400600123402340000
OLOW30450600123402540000
:     A=30.0,    H=8.0
OLOW30050800123400280000

----5----0----5----0----5----0----5----0----5----0----5----0----5----0----5----0
         1         2         3         4         5         6         7         8
```

Appendix G (Continued)

```
         1         2         3         4         5         6         7         8
----5----0----5----0----5----0----5----0----5----0----5----0----5----0----5----0

OLOW30100800123400570000
OLOW30150800123400860000
OLOW30200800123401120000
OLOW30250800123401340000
OLOW30300800123401560000
OLOW30350800123401760000
OLOW30400800123401940000
OLOW30450800123402120000
:     A=30.0,    H=10.0
OLOW30051000123400200000
OLOW30101000123400400000
OLOW30151000123400580000
OLOW30201000123400760000
OLOW30251000123400920000
OLOW30301000123401040000
OLOW30351000123401140000
OLOW30401000123401240000
OLOW30451000123401340000
OLOW30501000123401440000
OLOW30551000123401540000
OLOW30601000123401640000
OLOW30651000123401740000

----5----0----5----0----5----0----5----0----5----0----5----0----5----0----5----0
         1         2         3         4         5         6         7         8
```