```
=========================================================================LINEAR
                                                                        LINEAR
     PROGRAM LINEAR                                                     LINEAR
     ==============                                                     LINEAR
     VERSION 74-1 (MAY 1974)                                            LINEAR
     VERSION 75-1 (APRIL 1975)                                          LINEAR
     VERSION 76-2 (OCTOBER 1976)                                        LINEAR
     VERSION 77-1 (JANUARY 1977)                                        LINEAR
     VERSION 78-1 (JULY 1978)                                           LINEAR
     VERSION 79-1 (JULY 1979) CDC-7600 AND CRAY-1 VERSION.              LINEAR
     VERSION 80-1 (MAY 1980) IBM, CDC AND CRAY VERSION.                 LINEAR
     VERSION 80-2 (DECEMBER 1980)                                       LINEAR
     VERSION 81-1 (MARCH 1981)                                          LINEAR
     VERSION 82-1 (JANUARY 1982) IMPROVED COMPUTER COMPATIBILITY.       LINEAR
     VERSION 83-1 (JANUARY 1983) *MAJOR RE-DESIGN.                      LINEAR
                                 *PAGE SIZE INCREASED - 1002 TO 3006.   LINEAR
                                 *ELIMINATED COMPUTER DEPENDENT CODING. LINEAR
                                 *NEW, MORE COMPATIBLE I/O UNIT NUMBER. LINEAR
                                 *ADDED OPTION TO KEEP ALL ORIGINAL     LINEAR
                                  ENERGY POINTS FROM EVALUATION.        LINEAR
                                 *ADDED STANDARD ALLOWABLE ERROR OPTION LINEAR
                                  (CURRENTLY 0.1 PER-CENT).             LINEAR
     VERSION 83-2 (OCTOBER 1983) IMPROVED BASED ON USER COMMENTS.       LINEAR
     VERSION 84-1 (APRIL 1984)   IMPROVED BASED ON USER COMMENTS.       LINEAR
     VERSION 84-2 (JUNE 1984)   *UPDATED FOR ENDF/B-6 FORMATS.         LINEAR
                                *SPECIAL I/O ROUTINES TO GUARANTEE      LINEAR
                                 ACCURACY OF ENERGY.                    LINEAR
                                *DOUBLE PRECISION TREATMENT OF ENERGY   LINEAR
                                 (REQUIRED FOR NARROW RESONANCES).      LINEAR
     VERSION 85-1 (AUGUST 1985) *FORTRAN-77/H VERSION                   LINEAR
     VERSION 86-1 (JANUARY 1986)*ENDF/B-6 FORMAT                        LINEAR
     VERSION 87-1 (JANUARY 1987)*DOUBLE PRECISION TREATMENT OF CROSS    LINEAR
                                 SECTION                                LINEAR
     VERSION 88-1 (JULY 1988)   *OPTION...INTERNALLY DEFINE ALL I/O     LINEAR
                                 FILE NAMES (SEE, SUBROUTINE FILEIO     LINEAR
                                 FOR DETAILS).                          LINEAR
                                *IMPROVED BASED ON USER COMMENTS.       LINEAR
     VERSION 89-1 (JANUARY 1989)*PSYCHOANALYZED BY PROGRAM FREUD TO     LINEAR
                                 INSURE PROGRAM WILL NOT DO ANYTHING    LINEAR
                                 CRAZY.                                 LINEAR
                                *UPDATED TO USE NEW PROGRAM CONVERT     LINEAR
                                 KEYWORDS.                              LINEAR
                                *ADDED LIVERMORE CIVIC COMPILER         LINEAR
                                 CONVENTIONS.                           LINEAR
     VERSION 90-1 (JUNE 1990)   *EXTENDED TO LINEARIZE PHOTON           LINEAR
                                 INTERACTION DATA, MF=23 AND 27         LINEAR
                                *ADDED FORTRAN SAVE OPTION              LINEAR
                                *UPDATED BASED ON USER COMMENTS.        LINEAR
                                *NEW MORE CONSISTENT ENERGY OUTPUT      LINEAR
                                 ROUTINE.                               LINEAR
                                *WARNING...INPUT PARAMETER FORMAT       LINEAR
                                 HAS BEEN CHANGED...SEE DESCRIPTION     LINEAR
                                 BELOW.                                 LINEAR
     VERSION 91-1 (JULY 1991)   *ADDED INTERPOLATION LAW 6 - ONLY USED  LINEAR
                                 FOR CHARGED PARTICLE CROSS SECTIONS    LINEAR
                                 FOR COULOMB PENETRABILITIES.           LINEAR
     VERSION 92-1 (JANUARY 1992)*ADDED NU-BAR (TOTAL, DELAYED, PROMPT)  LINEAR
                                 POLYNOMIAL OR TABULATED ALL CONVERTED  LINEAR
                                 TO LINEARLY INTERPOLABLE               LINEAR
                                *INCREASED PAGE SIZE FROM 3006 TO 5010  LINEAR
                                 POINTS.                                LINEAR
                                *ALL ENERGIES INTERNALLY ROUNDED PRIOR  LINEAR
                                 TO CALCULATIONS.                       LINEAR
                                *COMPLETELY CONSISTENT I/O AND ROUNDING LINEAR
                                 ROUTINES - TO MINIMIZE COMPUTER        LINEAR
                                 DEPENDENCE.                            LINEAR
     VERSION 92-2 (JULY 1992)   *CORRECTED CONVERSION OF NU-BAR FROM    LINEAR
                                 POLYNOMIAL TO TABULATED - COPY         LINEAR
                                 SPONTANEOUS NU-BAR (BY DEFINITION      LINEAR
                                 THE SPONTANEOUS NU-BAR IS NOT AN       LINEAR
                                 ENERGY DEPENDENT QUANTITY).            LINEAR
```

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VERSION 93-1 (MARCH 1993)  *UPDATED FOR USE WITH LAHEY COMPILER   LINEAR
                            ON IBM-PCS.                          LINEAR
                           *INCREASED PAGE SIZE FROM 5010 TO     LINEAR
                            30000 POINTS                         LINEAR
VERSION 94-1 (JANUARY 1994)*VARIABLE ENDF/B DATA FILENAMES       LINEAR
                            TO ALLOW ACCESS TO FILE STRUCTURES   LINEAR
                            (WARNING - INPUT PARAMETER FORMAT    LINEAR
                            HAS BEEN CHANGED)                    LINEAR
                           *CLOSE ALL FILES BEFORE TERMINATING   LINEAR
                            (SEE, SUBROUTINE ENDIT)              LINEAR
VERSION 96-1 (JANUARY 1996) *COMPLETE RE-WRITE                   LINEAR
                            *IMPROVED COMPUTER INDEPENDENCE      LINEAR
                            *ALL DOUBLE PRECISION                LINEAR
                            *ON SCREEN OUTPUT                    LINEAR
                            *UNIFORM TREATMENT OF ENDF/B I/O     LINEAR
                            *IMPROVED OUTPUT PRECISION           LINEAR
                            *DEFINED SCRATCH FILE NAMES          LINEAR
                            *ALWAYS INCLUDE THERMAL VALUE        LINEAR
                            *INCREASED PAGE SIZE FROM 30000 TO   LINEAR
                             60000 POINTS                        LINEAR
VERSION 99-1 (MARCH 1999)   *CORRECTED CHARACTER TO FLOATING     LINEAR
                             POINT READ FOR MORE DIGITS          LINEAR
                            *UPDATED TEST FOR ENDF/B FORMAT      LINEAR
                             VERSION BASED ON RECENT FORMAT CHANGELINEAR
                            *GENERAL IMPROVEMENTS BASED ON       LINEAR
                             USER FEEDBACK                       LINEAR
VERSION 99-2 (JUNE 1999)    *ASSUME ENDF/B-VI, NOT V, IF MISSING LINEAR
                             MF=1, MT-451.                       LINEAR
VERS. 2000-1 (FEBRUARY 2000)*ADDED MF = 9 AND 10 LINEARIZATION   LINEAR
                            *GENERAL IMPROVEMENTS BASED ON       LINEAR
                             USER FEEDBACK                       LINEAR
VERS. 2002-1 (MAY 2002)     *OPTIONAL INPUT PARAMETERS           LINEAR
VERS. 2004-1 (JAN. 2004)    *GENERAL UPDATE BASED ON USER FEEDBACKLINEAR
VERS. 2005-1 (JAN. 2005)    *ALWAYS KEEP ORIGINAL TABULATED      LINEAR
                             NU-BAR POINTS.                      LINEAR
VERS. 2006-1 (FEB. 2006)    *CORRECTED INT=6 NEAR THRESHOLD      LINEAR
                            *NO SUBDIVIDE BELOW MINIMUM XCLOW    LINEAR
VERS. 2007-1 (JAN. 2007)    *CHECKED AGAINST ALL ENDF/B-VII.     LINEAR
                            *INCREASED PAGE SIZE FROM 60,000 TO  LINEAR
                             600,000 POINTS                      LINEAR
VERS. 2007-2 (DEC. 2007)    *72 CHARACTER FILE NAMES.            LINEAR
VERS. 2010-1 (Apr. 2010)    *Skipped leading cross section = 0   LINEAR
                             up to effective start, unless keepingLINEAR
                             ALL original energy points.         LINEAR
                            *Replaced ETHRES by ESTART - it is   LINEAR
                             not a threshold - just a minimum    LINEAR
                             energy - if a section starts above  LINEAR
                             this energy with a positive cross   LINEAR
                             section, an additional point will   LINEAR
                             inserted with cross section = 0.    LINEAR
VERS. 2012-1 (Aug. 2012)    *Minor Updates based on User Feedback.LINEAR
                            *Added CODENAME                      LINEAR
                            *32 and 64 bit Compatible            LINEAR
                            *Added ERROR stops.                  LINEAR
VERS. 2012-2 (Nov. 2012)    *Never thin nu-bar.                  LINEAR
VERS. 2013-1 (Nov. 2013)    *Extended OUT9.                      LINEAR
VERS. 2015-1 (Jan. 2015)    *Allow Imaginary Anomolous Scattering LINEAR
                             Factor to be Negative (MF/MT=27/506).LINEAR
                            *Replaced ALL 3 way IF Statements.   LINEAR
VERS. 2016-1 (June 2016)    *Cosmetic changes based on FREUD     LINEAR
                             psychoanalysis.                     LINEAR
VERS. 2017-1 (May  2017)    *Updated based on user feedback.     LINEAR
                            *Inceased page size to 3,000,000.    LINEAR
                            *All floating input parameters changedLINEAR
                             to character input + IN9 conversion. LINEAR
VERS. 2018-1 (Dec. 2018)    *Updated based on user feedback.     LINEAR
                            *Added on-line output for ALL ENDERRORLINEAR
VERS. 2019-1 (June 2019)    *Additional Interpolation Law Tests  LINEAR
                            *Checked Maximum Tabulated Energy to LINEAR
                             insure it is the same for all MTs - LINEAR
                             if not, print WARNING messages.     LINEAR
```

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                          *Corrected END Histogram linearized - LINEAR
                           Previously assumed Y = 0 and deleted LINEAR
                           now whatever the value it is includedLINEAR
VERS. 2020-1 (Dec. 2020)  *Major Re-write of Convergence        LINEAR
                          *Replaced INCORE9 by INCORE10.        LINEAR
                          *Added Target Isomer Flag             LINEAR
                          *Keep iterating toward MAX & MIN      LINEAR
VERS. 2021-1 (Mar. 2021)  *Complete re-write of convergence.    LINEAR
                          *Optionlly add MF/MT=1/451 comments   LINEAR
                          *Updated from FORTRAN 2018            LINEAR
                          *Minimum Cross Section is no longer   LINEAR
                           an input option = set to 1.0d-30.    LINEAR
                                                                LINEAR
OWNED, MAINTAINED AND DISTRIBUTED BY                            LINEAR
-----------------------------------                             LINEAR
THE NUCLEAR DATA SECTION                                        LINEAR
INTERNATIONAL ATOMIC ENERGY AGENCY                              LINEAR
P.O. BOX 100                                                    LINEAR
A-1400, VIENNA, AUSTRIA                                         LINEAR
EUROPE                                                          LINEAR
                                                                LINEAR
ORIGINALLY WRITTEN BY                                           LINEAR
-------------------------------------                           LINEAR
Dermott E. Cullen                                               LINEAR
                                                                LINEAR
PRESENT CONTACT INFORMATION                                     LINEAR
---------------------------                                     LINEAR
Dermott E. Cullen                                               LINEAR
1466 Hudson Way                                                 LINEAR
Livermore, CA 94550                                             LINEAR
U.S.A.                                                          LINEAR
Telephone  925-443-1911                                         LINEAR
E. Mail    RedCullen1@Comcast.net                               LINEAR
Website    RedCullen1.net/HOMEPAGE.NEW                          LINEAR
                                                                LINEAR
AUTHORS MESSAGE                                                 LINEAR
---------------                                                 LINEAR
THE REPORT DESCRIBED ABOVE IS THE LATEST PUBLISHED DOCUMENTATION  LINEAR
FOR THIS PROGRAM. HOWEVER, THE COMMENTS BELOW SHOULD BE CONSIDEREDLINEAR
THE LATEST DOCUMENTATION INCLUDING ALL RECENT IMPROVEMENTS. PLEASELINEAR
READ ALL OF THESE COMMENTS BEFORE IMPLEMENTATION.               LINEAR
                                                                LINEAR
AT THE PRESENT TIME WE ARE ATTEMPTING TO DEVELOP A SET OF COMPUTERLINEAR
INDEPENDENT PROGRAMS THAT CAN EASILY BE IMPLEMENTED ON ANY ONE  LINEAR
OF A WIDE VARIETY OF COMPUTERS. IN ORDER TO ASSIST IN THIS PROJECTLINEAR
IT WOULD BE APPECIATED IF YOU WOULD NOTIFY THE AUTHOR OF ANY    LINEAR
COMPILER DIAGNOSTICS, OPERATING PROBLEMS OR SUGGESTIONS ON HOW TO LINEAR
IMPROVE THIS PROGRAM. HOPEFULLY, IN THIS WAY FUTURE VERSIONS OF LINEAR
THIS PROGRAM WILL BE COMPLETELY COMPATIBLE FOR USE ON YOUR      LINEAR
COMPUTER.                                                       LINEAR
                                                                LINEAR
PURPOSE                                                         LINEAR
-------                                                         LINEAR
THIS PROGRAM IS DESIGNED TO CONVERT ENDF/B FILE 3, 23 AND 27 DATA LINEAR
TO LINEAR-LINEAR INTERPOLABLE FORM. ANY SECTION THAT IS ALREADY LINEAR
LINEAR-LINEAR INTERPOLABLE WILL BE THINNED.                     LINEAR
                                                                LINEAR
IN THE FOLLOWING DISCUSSION FOR SIMPLICITY THE ENDF/B TERMINOLOGY LINEAR
---ENDF/B TAPE---WILL BE USED. IN FACT THE ACTUAL MEDIUM MAY BE LINEAR
TAPE, CARDS, DISK OR ANY OTHER MEDIUM.                          LINEAR
                                                                LINEAR
ENDF/B FORMAT                                                   LINEAR
-------------                                                   LINEAR
THIS PROGRAM ONLY USES THE ENDF/B BCD OR CARD IMAGE FORMAT (AS  LINEAR
OPPOSED TO THE BINARY FORMAT) AND CAN HANDLE DATA IN ANY VERSION LINEAR
OF THE ENDF/B FORMAT (I.E., ENDF/B-1, 2, 3, 4, 5, 6 FORMAT).   LINEAR
                                                                LINEAR
IT IS ASSUMED THAT THE DATA IS CORRECTLY CODED IN THE ENDF/B    LINEAR
FORMAT AND NO ERROR CHECKING IS PERFORMED. IN PARTICULAR IT IS  LINEAR
ASSUMED THAT THE MAT, MF AND MT ON EACH LINE IS CORRECT. SEQUENCE LINEAR
NUMBERS (COLUMNS 76-80) ARE IGNORED ON INPUT, BUT WILL BE       LINEAR
```

```
CORRECTLY OUTPUT ON ALL LINES. THE FORMAT OF SECTION MF=1, MT=451 LINEAR
AND ALL SECTIONS OF MF=3 MUST BE CORRECT. THE PROGRAM COPIES ALL  LINEAR
OTHER SECTION OF DATA AS HOLLERITH AND AS SUCH IS INSENSITIVE TO  LINEAR
THE CORRECTNESS OR INCORRECTNESS OF ALL OTHER SECTIONS.           LINEAR
                                                                 LINEAR
OUTPUT FORMAT                                                    LINEAR
-------------                                                    LINEAR
IN THIS VERSION OF LINEAR ALL ENERGIES WILL BE OUTPUT IN         LINEAR
F (INSTEAD OF E) FORMAT IN ORDER TO ALLOW ENERGIES TO BE WRITTEN  LINEAR
WITH UP TO 9 DIGITS OF ACCURACY. IN PREVIOUS VERSIONS THIS WAS AN LINEAR
OUTPUT OPTION. HOWEVER USE OF THIS OPTION TO COMPARE THE RESULTS  LINEAR
OF ENERGIES WRITTEN IN THE NORMAL ENDF/B CONVENTION OF 6 DIGITS   LINEAR
TO THE 9 DIGIT OUTPUT FROM THIS PROGRAM DEMONSTRATED THAT FAILURE LINEAR
TO USE THE 9 DIGIT OUTPUT CAN LEAD TO LARGE ERRORS IN THE DATA    LINEAR
DUE TO TRUNCATION OF ENERGIES TO 6 DIGITS DURING OUTPUT.          LINEAR
                                                                 LINEAR
CONTENTS OF OUTPUT                                               LINEAR
------------------                                               LINEAR
ENTIRE EVALUATIONS ARE OUTPUT, NOT JUST THE LINEARIZED DATA       LINEAR
CROSS SECTIONS, E.G. ANGULAR AND ENERGY DISTRIBUTIONS ARE ALSO    LINEAR
INCLUDED.                                                        LINEAR
                                                                 LINEAR
DOCUMENTATION                                                    LINEAR
-------------                                                    LINEAR
THE FACT THAT THIS PROGRAM HAS OPERATED ON THE DATA IS DOCUMENTED LINEAR
BY THE ADDITION OF 3 COMMENT LINES AT THE END OF EACH HOLLERITH   LINEAR
SECTION IN THE FORM                                              LINEAR
                                                                 LINEAR
***************** PROGRAM LINEAR (2021-1) ****************       LINEAR
FOR ALL DATA GREATER THAN 1.00000-30 IN ABSOLUTE VALUE           LINEAR
DATA LINEARIZED TO WITHIN AN ACCURACY OF  0.1  PER-CENT          LINEAR
                                                                 LINEAR
THE ORDER OF SIMILAR COMMENTS (FROM RECENT, SIGMA1 AND GROUPIE)   LINEAR
REPRESENTS A COMPLETE HISTORY OF ALL OPERATIONS PERFORMED ON      LINEAR
THE DATA BY THESE PROGRAMS.                                      LINEAR
                                                                 LINEAR
THESE COMMENT LINES ARE ONLY ADDED TO EXISTING HOLLERITH SECTIONS,LINEAR
I.E., THIS PROGRAM WILL NOT CREATE A HOLLERITH SECTION. THE FORMATLINEAR
OF THE HOLLERITH SECTION IN ENDF/B-V DIFFERS FROM THE THAT OF     LINEAR
EARLIER VERSIONS OF ENDF/B. BY READING AN EXISTING MF=1, MT=451   LINEAR
IT IS POSSIBLE FOR THIS PROGRAM TO DETERMINE WHICH VERSION OF     LINEAR
THE ENDF/B FORMAT THE DATA IS IN. WITHOUT HAVING A SECTION OF     LINEAR
MF=1, MT=451 PRESENT IT IS IMPOSSIBLE FOR THIS PROGRAM TO         LINEAR
DETERMINE WHICH VERSION OF THE ENDF/B FORMAT THE DATA IS IN, AND  LINEAR
AS SUCH IT IS IMPOSSIBLE FOR THE PROGRAM TO DETERMINE WHAT FORMAT LINEAR
SHOULD BE USED TO CREATE A HOLLERITH SECTION.                    LINEAR
                                                                 LINEAR
REACTION INDEX                                                   LINEAR
--------------                                                   LINEAR
THIS PROGRAM DOES NOT USE THE REACTION INDEX WHICH IS GIVEN IN    LINEAR
SECTION MF=1, MT=451 OF EACH EVALUATION.                         LINEAR
                                                                 LINEAR
THIS PROGRAM DOES NOT UPDATE THE REACTION INDEX IN MF=1, MT=451.  LINEAR
THIS CONVENTION HAS BEEN ADOPTED BECAUSE MOST USERS DO NOT        LINEAR
REQUIRE A CORRECT REACTION INDEX FOR THEIR APPLICATIONS AND IT WASLINEAR
NOT CONSIDERED WORTHWHILE TO INCLUDE THE OVERHEAD OF CONSTRUCTING LINEAR
A CORRECT REACTION INDEX IN THIS PROGRAM. HOWEVER, IF YOU REQUIRE LINEAR
A REACTION INDEX FOR YOUR APPLICATIONS, AFTER RUNNING THIS PROGRAMLINEAR
YOU MAY USE PROGRAM DICTIN TO CREATE A CORRECT REACTION INDEX.    LINEAR
                                                                 LINEAR
SECTION SIZE                                                     LINEAR
------------                                                     LINEAR
SINCE THIS PROGRAM USES A LOGICAL PAGING SYSTEM THERE IS NO LIMIT LINEAR
TO THE NUMBER OF POINTS IN ANY SECTION, E.G., THE TOTAL CROSS     LINEAR
SECTION MAY BE REPRESENTED BY 200,000 DATA POINTS.               LINEAR
                                                                 LINEAR
FOR ANY LINEARIZED SECTION THAT CONTAINS 60000 OR FEWER POINTS    LINEAR
THE ENTIRE OPERATION WILL BE PERFORMED IN CORE AND THE LINEARIZED LINEAR
DATA WILL BE OUTPUT DIRECTLY TO THE ENDF/B FORMAT. FOR ANY SECTIONLINEAR
THAT CONTAINS MORE POINTS THE DATA WILL BE LINEARIZED A PAGE AT A LINEAR
TIME (1 PAGE = 60000 POINTS) AND OUTPUT TO SCRATCH. AFTER THE     LINEAR
```

ENTIRE SECTION HAS BEEN LINEARIZED THE DATA WILL BE READ BACK FROM LINEAR
SCRATCH AND OUTPUT TO THE ENDF/B FORMAT. LINEAR
LINEAR
SELECTION OF DATA LINEAR
---------- LINEAR
THE PROGRAM SELECTS DATA TO BE LINEARIZED BASED EITHER ON EITHER LINEAR
MAT (ENDF/B MAT NO.) OR ZA AS WELL AS MF AND MT NUMBERS. THIS LINEAR
PROGRAM ALLOWS UP TO 100 MAT/MF/MT OR ZA/MF/MT RANGES TO BE LINEAR
SPECIFIED BY INPUT PARAMETERS. THE PROGRAM WILL ASSUME THAT THE LINEAR
ENDF/B TAPE IS IN MAT ORDER, REGARDLESS OF THE CRITERIA USED LINEAR
TO RETRIEVE MATERIALS. IF RETRIEVAL IS BY MAT RANGE THE PROGRAM LINEAR
WILL TERMINATE WHEN A MAT IS FOUND THAT IS ABOVE ALL REQUESTED LINEAR
MAT RANGES. IF RETRIEVAL IS BY ZA RANGE THE PROGRAM WILL SEARCH LINEAR
THE ENTIRE ENDF/B TAPE. LINEAR
LINEAR
PROGRAM OPERATION LINEAR
---------- LINEAR
EACH SECTION OF DATA IS CONSIDERED SEPARATELY. EACH SECTION OF LINEAR
ENDF/B DATA TO LINEARIZE IS REPRESENTED BY A TABLE OF ENERGY LINEAR
VS. CROSS SECTION AND ANY ONE OF FIVE ALLOWABLE INTERPOLATION LAWS LINEAR
BETWEEN ANY TWO TABULATED POINTS. THIS PROGRAM WILL REPLACE EACH LINEAR
SECTION OF DATA CROSS SECTIONS BY A NEW TABLE OF ENERGY VS. LINEAR
CROSS SECTION IN WHICH THE INTERPOLATION LAW IS ALWAYS LINEAR IN LINEAR
ENERGY AND CROSS SECTION BETWEEN ANY TWO TABULATED POINTS. LINEAR
LINEAR
DATA IS READ AND LINEARIZED A PAGE AT A TIME (ONE PAGE CONTAINS LINEAR
60000 DATA POINTS). IF THE FINAL LINEARIZED SECTION CONTAINS TWO LINEAR
PAGES OR LESS, DATA POINTS IT WILL BE ENTIRELY CORE RESIDENT LINEAR
AFTER IT HAS BEEN LINEARIZED AND WILL BE WRITTEN DIRECTLY FROM LINEAR
CORE TO THE OUTPUT TAPE. IF THE LINEARIZED SECTION IS LARGER THAN LINEAR
TWO PAGES, AFTER EACH PAGE IS LINEARIZED IT WILL BE WRITTEN TO LINEAR
SCRATCH. AFTER THE ENTIRE SECTION HAS BEEN LINEARIZED IT WILL LINEAR
BE READ BACK FROM SCRATCH, TWO PAGES AT A TIME, AND WRITTEN TO LINEAR
THE OUTPUT TAPE. LINEAR
LINEAR
KEEP EVALUATED DATA POINTS LINEAR
-------------------------- LINEAR
SOMETIMES IT IS CONVENIENT TO KEEP ALL ENERGY POINTS WHICH WERE LINEAR
PRESENT IN THE ORIGINAL EVALUATION AND TO MERELY SUPPLEMENT THESE LINEAR
POINTS WITH ADDITIONAL ENERGY POINTS IN ORDER TO LINEARIZE THE LINEAR
CROSS SECTIONS. FOR EXAMPLE, IT IS OFTEN CONVENIENT TO KEEP THE LINEAR
THERMAL VALUE (AT 0.0253 EV) OR THE VALUE AT 14.1 MEV. LINEAR
LINEAR
THE CURRENT VERSION OF THIS PROGRAM WILL ALLOW THE USER TO KEEP LINEAR
ALL ORIGINAL EVALUATED DATA POINTS BY SPECIFYING 1 IN COLUMNS LINEAR
34-44 OF THE FIRST INPUT LINE. THIS WILL TURN OFF THE BACKWARD LINEAR
THINNING (SEE UCRL-50400, VOL. 17, PART A FOR EXPLANATION) AND LINEAR
RESULT IN ALL ORIGINAL ENERGY POINTS BEING KEPT. CAUTION SHOULD LINEAR
BE EXERCISED IN USING THIS OPTION SINCE IT CAN RESULT IN A LINEAR
CONSIDERABLE INCREASE IN THE NUMBER OF DATA POINTS OUTPUT BY LINEAR
THIS CODE. LINEAR
LINEAR
FOR ALL USERS WHO ARE NOT INTERESTED IN THIS OPTIONS NO CHANGES LINEAR
ARE REQUIRED IN THE INPUT TO THIS PROGRAM, I. E. IF COLUMNS LINEAR
34-44 ARE BLANK (AS FOR ALL PREVIOUS VERSIONS OF THIS CODE) THE LINEAR
PROGRAM WILL OPERATE EXACTLY AS IT DID BEFORE. LINEAR
LINEAR
ALLOWABLE ERROR LINEAR
--------------- LINEAR
ALLOWABLE ERROR MUST ALWAYS BE SPECIFIED IN THE INPUT TO THIS LINEAR
PROGRAM AS A FRACTION, NOT A PER-CENT. FOR EXAMPLE, INPUT THE LINEAR
ALLOWABLE FRACTIONAL ERROR 0.001 IN ORDER TO OBTAIN DATA THAT IS LINEAR
ACCURATE TO WITHIN 0.1 PER-CENT. LINEAR
LINEAR
THE CONVERSION OF THE DATA FROM THE GENERAL INTERPOLATION FORM TO LINEAR
LINARLY INTERPOLABLE FORM CANNOT BE PERFORMED EXACTLY. HOWEVER, IT LINEAR
CAN BE PERFORMED TO VIRTUALLY ANY REQUIRED ACCURACY AND MOST LINEAR
IMPORTANTLY CAN BE PERFORMED TO A TOLERANCE THAT IS SMALL COMPARED LINEAR
TO THE UNCERTAINTY IN THE CROSS SECTIONS THEMSELVES. AS SUCH THE LINEAR
CONVERSION OF CROSS SECTIONS TO LINEARLY INTERPOLABLE FORM CAN BE LINEAR
PERFORMED WITH ESSENTIALLY NO LOSE OF INFORMATION. LINEAR

```
                                                                      LINEAR
THE ALLOWABLE ERROR MAY BE ENERGY INDEPENDENT (CONSTANT) OR ENERGYLINEAR
DEPENDENT. THE ALLOWABLE ERROR IS DESCRIBED BY A TABULATED        LINEAR
FUNCTION OF UP TO 20 (ENERGY,ERROR) PAIRS AND LINEAR INTERPOLATIONLINEAR
BETWEEN TABULATED POINTS. IF ONLY ONE TABULATED POINT IS GIVEN THELINEAR
ERROR WILL BE CONSIDERED CONSTANT OVER THE ENTIRE ENERGY RANGE.   LINEAR
WITH THIS ENERGY DEPENDENT ERROR ONE MAY OPTIMIZE THE OUTPUT FOR  LINEAR
ANY GIVEN APPLICATION BY USING A SMALL ERROR IN THE ENERGY RANGE  LINEAR
OF INTEREST AND A LESS STRINGENT ERROR IN OTHER ENERGY RANGES.    LINEAR
                                                                  LINEAR
DEFAULT ALLOWABLE ERROR                                           LINEAR
-----------------------                                           LINEAR
IN ORDER TO INSURE CONVERGENCE OF THE LINEARIZING ALGORITHM THE   LINEAR
ALLOWABLE ERROR MUST BE POSITIVE. IF THE USER INPUTS AN ERROR     LINEAR
THAT IS NOT POSITIVE IT WILL AUTOMATICALLY BE SET TO THE DEFAULT  LINEAR
VALUE (CURRENTLY 0.001, CORRESPONDING TO 0.1 PER-CENT) AND        LINEAR
INDICATED AS SUCH IN THE OUTPUT LISTING.                          LINEAR
                                                                  LINEAR
COULOMB PENETRABILITY (INTERPOLATION LAW = 6)                     LINEAR
---------------------------------------------                     LINEAR
INTRODUCED FOR ENDF/B-VI. THIS IS DEFINED AS,                     LINEAR
                                                                  LINEAR
SIG(E) = C1*EXP(-C2/SQRT(E - T))                                  LINEAR
                                                                  LINEAR
THIS PROGRAM ONLY CONSIDERS EXOTHERMIC REACTIONS - T = 0          LINEAR
                                                                  LINEAR
SIG(E) = C1*EXP(-C2/SQRT(E))                                      LINEAR
                                                                  LINEAR
WARNING...THIS INTERPOLATION LAW SHOULD ONLY BE USED FOR REACTIONSLINEAR
          WHICH HAVE A POSITIVE Q-VALUE (EXOTHERMIC REACTIONS),   LINEAR
          SINCE HERE WE ONLY CONSIDER T = 0.0 IN THE FORMALISM.   LINEAR
          IN ALL OTHER CASES A WARNING MESSAGE WILL BE PRINTED.   LINEAR
                                                                  LINEAR
INPUT FILES                                                       LINEAR
-----------                                                       LINEAR
UNIT  DESCRIPTION                                                 LINEAR
----  -----------                                                 LINEAR
   2  INPUT LINES (BCD - 80 CHARACTERS/RECORD)                    LINEAR
  10  ORIGINAL ENDF/B DATA (BCD - 80 CHARACTERS/RECORD)           LINEAR
                                                                  LINEAR
OUTPUT FILES                                                      LINEAR
------------                                                      LINEAR
UNIT  DESCRIPTION                                                 LINEAR
----  -----------                                                 LINEAR
   3  OUTPUT REPORT (BCD - 120 CHARACTERS/RECORD)                 LINEAR
  11  FINAL ENDF/B DATA (BCD - 80 CHARACTERS/RECORD)              LINEAR
                                                                  LINEAR
SCRATCH FILES                                                     LINEAR
-------------                                                     LINEAR
UNIT  DESCRIPTION                                                 LINEAR
----  -----------                                                 LINEAR
  12  SCRATCH FILE (BINARY - 180000 WORDS/RECORD                  LINEAR
                                                                  LINEAR
OPTIONAL STANDARD FILE NAMES (SEE SUBROUTINE FILEIO)              LINEAR
----------------------------------------------------              LINEAR
UNIT  FILE NAME                                                   LINEAR
----  ----------                                                  LINEAR
  2   LINEAR.INP                                                  LINEAR
  3   LINEAR.LST                                                  LINEAR
 10   ENDFB.IN                                                    LINEAR
 11   ENDFB.OUT                                                   LINEAR
 12   (SCRATCH)                                                   LINEAR
                                                                  LINEAR
                                                                  LINEAR
INPUT PARAMETERS                                                  LINEAR
----------------                                                  LINEAR
FOR VERSIONS EARLIER THAN 90-1 THIS PROGRAM ONLY ALLOWED THE USER LINEAR
TO SPECIFY BY INPUT PARAMETERS WHICH MATERIALS (MAT) TO PROCESS.  LINEAR
FOR EACH REQUESTED MATERIAL NEUTRON INTERACTION CROSS SECTIONS    LINEAR
(MF=3) WOULD BE LINEARIZED AND THE REMAINDER OF THE MATERIAL      LINEAR
WOULD BE COPIED.                                                  LINEAR
```

```
                                                                      LINEAR
FOR VERSIONS 90-1 AND LATER THIS PROGRAM WILL ALLOW THE USER TO       LINEAR
TO SPECIFY BY INPUT PARAMETERS EXACTLY WHAT SECTIONS OF DATA          LINEAR
TO PROCESS. FOR EACH SECTION OF DATA, SPECIFIED BY MAT, MF, MT        LINEAR
RANGES, SECTIONS OF MF=3, 23 AND 27 WILL BE LINEARIZED AND ALL        LINEAR
OTHER REQUESTED SECTIONS WILL BE COPIED. ALL SECTIONS WHICH ARE       LINEAR
NOT EXPLICITLY REQUESTED WILL BE SKIPPED AND WILL NOT APPEAR ON       LINEAR
ENDF/B FILE OUTPUT BY THIS PROGRAM.                                   LINEAR
                                                                      LINEAR
WITH THIS NEW PROCEDURE YOU CAN MINIMIZE THE SIZE OF THE ENDF/B       LINEAR
FILE OUTPUT BY THIS PROGRAM, E.G., IF YOU ONLY WANT NEUTRON           LINEAR
CROSS SECTIONS FOR SUBSEQUENT PROCESSING YOU NEED ONLY REQUEST        LINEAR
ONLY MF=3 DATA.                                                       LINEAR
                                                                      LINEAR
HOWEVER, YOU MUST UNDERSTAND THAT ONLY THOSE SECTIONS WHICH YOU       LINEAR
EXPLICITLY REQUEST WILL APPEAR ON THE ENDF/B FILE OUTPUT BY           LINEAR
THIS PROGRAM. FOR EXAMPLE, IF YOU WISH TO DOCUMENT EXACTLY            LINEAR
HOW YOU LINEARIZED THE DATA BY INCLUDING COMMENTS IN MF=1, MT=451     LINEAR
THEN YOU MUST EXPLICITLY REQUEST THAT MF=1, MT=451 BE PROCESSED       LINEAR
FOR EACH MATERIAL THAT YOU REQUEST. SIMILAR IF YOU WANT THE           LINEAR
ENTIRE EVALUATION YOU MUST REQUEST ALL MF AND MT TO BE OUTPUT.        LINEAR
                                                                      LINEAR
LINE  COLS.  DESCRIPTION                                              LINEAR
----  -----  -----------                                              LINEAR
   1   1-11  SELECTION CRITERIA (0=MAT, 1=ZA)                         LINEAR
      12-22  MONITOR MODE SELECTOR                                    LINEAR
             = 0 - NORMAL OPERATION                                   LINEAR
             = 1 - MONITOR PROGRESS OF LINEARIZING OF THE DATA.       LINEAR
                   EACH TIME A PAGE OF DATA POINTS IS WRITTEN TO      LINEAR
                   THE SCRATCH FILE PRINT OUT THE TOTAL NUMBER OF     LINEAR
                   POINTS ON SCRATCH AND THE LOWER AND UPPER          LINEAR
                   ENERGY LIMITS OF THE PAGE (THIS OPTION MAY BE      LINEAR
                   USED IN ORDER TO MONITOR THE EXECUTION SPEED       LINEAR
                   OF LONG RUNNING JOBS).                             LINEAR
      23-33  MINIMUM CROSS SECTION OF INTEREST (BARNS).               LINEAR
             (IF 0.0 OR LESS IS INPUT THE PROGRAM WILL                LINEAR
             USE 1.0E-10). ENERGY INTERVALS WILL NOT BE               LINEAR
             SUB-DIVIDED IF THE ABSOLUTE VALUE OF THE CROSS           LINEAR
             SECTION WITHIN THE INTERVAL IS LESS THAN THIS VALUE.     LINEAR
             AN EXCEPTION TO THIS RULE IS NEAR THRESHOLDS ENERGY      LINEAR
             INTERVALS WILL BE SUB-DIVIDED UNTIL CONVERGENCE          LINEAR
             REGARDLESS OF THE MAGNITUDE OF THE CROSS SECTION.        LINEAR
      34-44  KEEP ORIGINAL EVALUATED DATA POINTS.                     LINEAR
             = 0 - NO.                                                LINEAR
             = 1 - YES - ADDITIONAL POINTS MAY BE ADDED IN ORDER      LINEAR
                         TO LINEARIZE DATA, BUT ALL ORIGINAL          LINEAR
                         DATA POINTS WILL BE INCLUDED IN THE          LINEAR
                         RESULTS.                                     LINEAR
   2   1-72  ENDF/B INPUT DATA FILENAME                               LINEAR
             (STANDARD OPTION = ENDFB.IN)                             LINEAR
   3   1-72  ENDF/B OUTPUT DATA FILENAME                              LINEAR
             (STANDARD OPTION = ENDFB.OUT)                            LINEAR
 4-N   1- 6  LOWER MAT OR ZA LIMIT                                    LINEAR
       7- 8  LOWER MF LIMIT                                           LINEAR
       9-11  LOWER MT LIMIT                                           LINEAR
      12-17  UPPER MAT OR ZA LIMIT                                    LINEAR
      18-19  UPPER MF LIMIT                                          LINEAR
      20-22  UPPER MT LIMIT                                          LINEAR
             UP TO 100 RANGES MAY BE SPECIFIED, ONLY ONE RANGE        LINEAR
             PER LINE. THE LIST OF RANGES IS TERMINATED BY A          LINEAR
             BLANK LINE. IF THE UPPER MAT LIMIT OF ANY REQUEST        LINEAR
             IS LESS THAN THE LOW LIMIT IT WILL BE SET EQUAL TO       LINEAR
             THE LOWER LIMIT. IF THE UPPER LIMIT IS STILL ZERO        LINEAR
             IT WILL BE SET EQUAL TO 999999. IF THE UPPER MF OR       LINEAR
             MT LIMIT IS ZERO IT WILL BE SET TO 99 OR 999             LINEAR
             RESPECTIVELY.                                            LINEAR
VARY   1-11  ENERGY FOR ERROR LAW                                     LINEAR
      12-22  ALLOWABLE FRACTIONAL ERROR FOR ERROR LAW.                 LINEAR
             THE ACCEPTABLE LINEARIZING ERROR MAY BE SPECIFIED TO     LINEAR
             BE EITHER ENERGY INDEPENDENT (DEFINED BY A SINGLE        LINEAR
             ERROR), OR ENERGY DEPENDENT (DEFINED BY UP TO 20         LINEAR
```

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                ENERGY, ERROR PAIRS). FOR THE ENERGY DEPENDENT CASE  LINEAR
                LINEAR INTERPOLATION WILL BE USED TO DEFINE THE ERRORLINEAR
                AT ENERGIES BETWEEN THOSE AT WHICH IT IS TABULATED.  LINEAR
                IN ALL CASES THE ERROR LAW IS TERMINATED BY A BLANK  LINEAR
                LINE. IF ONLY ONE ENERGY, ERROR PAIR IS GIVEN THE    LINEAR
                THE LAW WILL BE CONSIDERED TO BE ENERGY INDEPENDENT. LINEAR
                IF MORE THAN ONE PAIR IS GIVEN IT WILL BE CONSIDERED LINEAR
                TO BE ENERGY DEPENDENT (NOTE, ENERGY INDEPENDENT     LINEAR
                FORM WILL RUN FASTER THAN THE EQUIVALENT ENERGY      LINEAR
                DEPENDENT FORM). FOR AN ENERGY DEPENDENT ERROR LAW   LINEAR
                ALL ENERGIES MUST BE ASCENDING ENERGY ORDER. FOR     LINEAR
                CONVERGENCE OF THE LINEARIZING ALGORITHM ALL ERRORS  LINEAR
                MUST BE POSITIVE. IF AN ALLOWABLE ERROR IS NOT       LINEAR
                POSITIVE IT WILL BE SET EQUAL TO THE STANDARD OPTION LINEAR
                (CURRENTLY 0.001, CORRESPONDING TO 0.1 PER-CENT).    LINEAR
                IF THE FIRST ERROR LINE IS BLANK IT WILL TERMINATE   LINEAR
                THE ERROR LAW AND THE ERROR WILL BE TREATED AS       LINEAR
                ENERGY INDEPENDENT, EQUAL TO THE STANDARD OPTION     LINEAR
                (CURRENTLY 0.1 PER-CENT). (SEE EXAMPLE INPUT 4).     LINEAR
                                                                     LINEAR
    EXAMPLE INPUT NO. 1                                              LINEAR
    ------------------                                               LINEAR
    RETRIEVE DATA BY ZA IN ORDER TO FIND ALL URANIUM ISOTOPES AND    LINEAR
    THORIUM 232. RETRIEVE ALL NEUTRON INTERACTION CROSS SECTIONS     LINEAR
    (MF=3). ALL ENERGY INTERVALS IN WHICH THE CROSS SECTION IS       LINEAR
    AT LEAST 1 MICRO-BARN (1.0E-06 BARNS) WILL BE SUBDIVIDED.        LINEAR
    BACKWARD THINNING WILL BE PERFORMED. FROM 0 TO 100 EV LINEARIZE  LINEAR
    TO WITHIN 0.1 PER-CENT ACCURACY. FROM 100 EV TO 1 KEV VARY       LINEAR
    ACCURACY BETWEEN 0.1 AND 1.0 PER-CENT. ABOVE 1 KEV USE 1         LINEAR
    PER-CENT ACCURACY.                                               LINEAR
                                                                     LINEAR
    EXPLICITLY SPECIFY THE STANDARD FILENAMES.                       LINEAR
                                                                     LINEAR
    IN THIS CASE THE FOLLOWING 11 INPUT LINES ARE REQUIRED           LINEAR
                                                                     LINEAR
         1          0 1.00000- 6          0                        LINEAR
ENDFB.IN                                                             LINEAR
ENDFB.OUT                                                            LINEAR
92000 3  0 92999 3999                                                LINEAR
90232 3  0     0 3  0    (UPPER LIMIT AUTOMATICALLY SET TO 90232 3999)LINEAR
                         (END OF REQUEST LIST)                       LINEAR
0.00000+ 0 1.00000-03                                                LINEAR
1.00000+ 2 1.00000-03                                                LINEAR
1.00000+ 3 1.00000-02                                                LINEAR
1.00000+ 9 1.00000-02                                                LINEAR
                         (END OF ERROR LAW)                          LINEAR
                                                                     LINEAR
    EXAMPLE INPUT NO. 2                                              LINEAR
    ------------------                                               LINEAR
    SAME AS THE ABOVE CASE, EXCEPT LINEARIZE ALL DATA TO WITHIN THE  LINEAR
    STANDARD ACCURACY (CURRENTLY 0.1 PER-CENT). IN ORDER TO USE THE  LINEAR
    STANDARD ACCURACY YOU NEED NOT SPECIFY ANY ERROR LAW AT ALL. IN  LINEAR
    THIS CASE INCLUDE THE HOLLERITH SECTION, MF=1, MT=451, FOR EACH  LINEAR
    MATERIAL.                                                        LINEAR
                                                                     LINEAR
    LEAVE THE DEFINITION OF THE FILENAMES BLANK - THE PROGRAM WILL   LINEAR
    THEN USE STANDARD FILENAMES.                                     LINEAR
                                                                     LINEAR
    IN THIS CASE THE FOLLOWING 9 INPUT LINES ARE REQUIRED            LINEAR
                                                                     LINEAR
         1          0 1.00000- 6          0                        LINEAR
                         (USE DEFAULT FILENAME = ENDFB.IN)           LINEAR
                         (USE DEFAULT FILENAME = ENDFB.OUT)          LINEAR
92000 1451 92999 1451                                                LINEAR
92000 3  0 92999 3999                                                LINEAR
90232 1451     0 1451                                                LINEAR
90232 3  0     0 3  0    (UPPER LIMIT AUTOMATICALLY SET TO 90232 3999)LINEAR
                         (END OF REQUEST LIST)                       LINEAR
                         (0.1 PER-CENT ERROR, END OF ERROR LAW)      LINEAR
                                                                     LINEAR
    EXAMPLE INPUT NO. 3                                              LINEAR
```

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    -------------------                                                 LINEAR
    LINEARIZE ALL MATERIALS ON AN ENDF/B TAPE TO WITHIN AN ACCURACY     LINEAR
    OF 0.5 PER-CENT (0.005 AS A FRACTION). IN THIS CASE YOU NEED NOT    LINEAR
    SPECIFY THE MAT, MF, MT RANGES.                                     LINEAR
                                                                        LINEAR
    READ THE ENDF/B DATA FROM \ENDFB6\ZA092238 AND WRITE THE ENDF/B     LINEAR
    DATA TO \ENDFB6\LINEAR\ZA092238.                                    LINEAR
                                                                        LINEAR
    IN THIS CASE THE FOLLOWING 6 INPUT LINES ARE REQUIRED               LINEAR
                                                                        LINEAR
                                          (MAT, 1.0E-10 BARNS, THIN)LINEAR
\ENDFB6\ZA092238                                                        LINEAR
\ENDFB6\LINEAR\ZA092238                                                 LINEAR
                      (RETRIEVE ALL DATA, END REQUEST LIST)             LINEAR
          5.00000-03                                                    LINEAR
                      (END OF ERROR LAW)                                LINEAR
                                                                        LINEAR
    NOTE THAT IN THIS CASE IF THE INPUT HAD SPECIFIED AN EQUIVALENT     LINEAR
    ENERGY DEPENDENT ERROR LAW BY GIVING A NUMBER OF ENERGY POINTS      LINEAR
    AT EACH OF WHICH THE ERROR IS 0.5 PER-CENT THE PROGRAM WOULD TAKE   LINEAR
    LONGER TO RUN (I.E., ONLY USE AN ENERGY DEPENDENT ERROR LAW WHEN    LINEAR
    IT IS NECESSARY).                                                   LINEAR
                                                                        LINEAR
    EXAMPLE INPUT NO. 4                                                 LINEAR
    -------------------                                                 LINEAR
    IN ORDER TO LINEARIZE ALL MATERIALS ON AN ENDF/B TAPE TO THE        LINEAR
    STANDARD OPTION OF 0.1 PER-CENT IT IS ADEQUATE TO INPUT A SET       LINEAR
    OF COMPLETELY BLANK LINES WHICH WILL AUTOMATICALLY INVOKE ALL       LINEAR
    OF THE STANDARD OPTIONS.                                            LINEAR
                                                                        LINEAR
    LEAVE THE DEFINITION OF THE FILENAMES BLANK - THE PROGRAM WILL      LINEAR
    THEN USE STANDARD FILENAMES.                                        LINEAR
                                                                        LINEAR
    IN THIS CASE THE FOLLOWING THREE INPUT LINES ARE REQUIRED           LINEAR
                                                                        LINEAR
                                          (MAT, 1.0E-10 BARNS, THIN)LINEAR
                      (USE DEFAULT FILENAME = ENDFB.IN)                 LINEAR
                      (USE DEFAULT FILENAME = ENDFB.OUT)                LINEAR
                      (RETRIEVE ALL DATA, END REQUEST LIST)             LINEAR
                      (0.1 PER-CENT ERROR, END OF ERROR LAW)            LINEAR
                                                                        LINEAR
========================================================================LINEAR
```