**=======================================================================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 OPTIONLINEAR**

**(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 ROUNDINGLINEAR**

**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**

**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**

**\*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**

**VERS. 2023-1 (Feb. 2023) \*Decreased in-core page size from LINEAR**

**6,000,000 ro 120,000 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**

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**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 (2023-1) \*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\* 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 FROMLINEAR**

**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 LAWSLINEAR**

**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, ITLINEAR**

**CAN BE PERFORMED TO VIRTUALLY ANY REQUIRED ACCURACY AND MOST LINEAR**

**IMPORTANTLY CAN BE PERFORMED TO A TOLERANCE THAT IS SMALL COMPAREDLINEAR**

**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**

**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**

**------------------- 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**