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Two Auxiliary Codes for Use with RENUPAK

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Abstract

Two IBM-7090 codes have been written to aid the user of the neutron moments method code RENUPAK. One code computes and punches response function input cards for RENUPAK or NIOBE (another neutron transport code). The second code reads RENUPAK flux tapes and prints out a compact edit including dose rate as a function of distance.

Two IBM-7090 codes have been written to aid the user of RENUPAK.[1] The RENUPAK code, developed at United Nuclear Corp. (NDA), solves the neutron slowing down problem in an infinite homogeneous medium for a point isotropic source.

(1) Response Function Code

An option of RENUPAK, and NIOBE[2] also, is the integration over energy of the flux weighted by a response function. Typical response functions are flux-to-dose conversion factors or heating cross sections. A large number of these are generally required at equal lethargy intervals. The Response Function Code will provide them on punched cards in the required format using the AUXØUT output of the ORGDP IBM-7090 monitor system. The input is a list of convenient energies, and response function values at those energies, on cards in FORTRAN input format. There is an option so that either RENUPAK or NIOBE type cards are produced. The output values are computed by log-log interpolation between input values. A printout of the computed values is also given. A special FORTRAN output package is included in the code so that + signs are punched in exponent fields as required by the RENUPAK input.

(2) RENUPAK Tape Edit

The spacial-energy distribution output of RENUPAK appears on logical tape 8, hereafter referred to as flux tape, as well as in the normal output. The normal output of RENUPAK is voluminous and not suitable for direct reproduction for publication. Therefore, an edit code was written to read one, or more, flux tapes and produce the spacial-energy distribution on 8-1/2 x 11 in. paper. In addition, the dose rate (or the result of any other response function) may be computed, at the user's option, and printed out. The integration is carried out over lethargy by Simpson's rule using all values computed by RENUPAK if the number of steps is even. The lowest energy value is omitted otherwise.

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1. Computer Code Abstract, 9-RENUPAK (UNC-90-1), Nuclear Sci. and Eng. 12, 3, p. 446 (1962); also J. Certaine et al., "RENUPAK, An IBM-704 Program for Neutron Moment Calculations," NDA-2120-3 (Dec., 1959).
2. Computer Code Abstracts, 9-NIOBE (UNC-90-2), Nuclear Sci. and Eng. 12, 3, p. 447 (1962); also S. Preiser et al., "A Program for the Numerical Integration of the Boltzmann Transport Equation - NIOBE," ARL-TR-60-314 (Dec., 1960).

Various quantities may be computed by RENUPAK, i.e., exponential flux, Gaussian flux, exponential current, and Gaussian current. These will appear on the RENUPAK output in a certain order. The tape edit code will pick up one of these quantities at one pass over the tapes. A number, called KIND, specifying which quantity, must be given in the input. The integer 1 will direct the edit to select the first one, a 2, the second one, etc. Any or all of these quantities may be obtained on a run by providing a card for each one.

Values at 15 distances can be stored on one flux tape and so generally several tapes are required. The tapes will be read in order automatically depending on the first distance (from the source) value. The tape with the smallest distance will be read first and the fluxes on that tape will be printed out first. The tape with the next largest first distance will be read next and so on. If the last distance on a tape is identical with the first distance on the following tape, only one print out of that distance will be made.

In case RENUPAK fails to give values at certain points, or if the flux is negative, the printed value will be zero.

Not all the tape need be read. The number of energy steps to be read is an input number.

A subroutine REDREN is used and is available for use in other codes. This routine reads the values of the distances and fluxes from tape, computes the energy values and transmits the data to memory. The logical tape numbers are 1 to N where N is the total number of tapes. The call statement is

CALL REDREN(N,KIND,EZERØ,JAY,DELU,E,NØDIST,DIST,FLUX)

where

N = total number of tapes;

KIND = FORTRAN integer giving order of desired quantity (described above);

EZERØ = highest energy (Mev);

JAY = integer giving the number of lethargy steps to be read from tape;

DELU = value of lethargy step;

E = dimensioned array of energies at the lethargy steps;
E(1) = EZERØ,

NØDIST = FORTRAN integer giving number of distances;

DIST = dimensioned array of distances as read from tape;

FLUX = doubly dimensioned array of fluxes; the first index gives energy; the second gives distance.

The values of the first five parameters are supplied by the user; the values of the rest are generated by REDREN.

Copies of these codes are available from the author.

Input Summary

1. RENUPAK Response Function

	FORMAT	
	(2E9.2,2I6)	EZERØ, DELU, JAY, NØREG.
	(I4)	Number of response functions.
repeated as necessary	(I4)	Number of response function values.
	(10E7.2)	E, F(E), repeated as necessary.

EZERØ = highest energy (Mev),
DELU = lethargy step,
JAY = number of lethargy steps,
NØREG = number of regions for NIOBE,
= 0 (or blank) for RENUPAK,
E = energy (Mev), energy values must either monotonically increase or decrease,
F(E) = response function value at E.

Tape Requirements

10 Input
9 Output
1 AUXØUT

Input Summary

2. Tape Edit Code

	FORMAT	
	(I4)	number of flux-to-dose functions (≤ 3).
repeat as necessary	(I4)	Number of dose values.
	(10E7.2)	E, D(E), repeated as necessary; E must monotonically decrease.
	(I4)	N, number of RENUPAK tapes, $N \leq 5$.
repeat as necessary	(F9.2,I4,F6.2)	EZERØ,JAY,DELU.
	(2I4)	KIND, Output option.
	(12A6)	Two lines of title to appear on each page of output.
	(12A6)	

EZERØ,DELU,JAY,E,KIND - defined previously,

D(E) = flux-to-dose conversion factor at E,

Output option = 0 for no dose output, conversion factors are ignored.

= 1 for normal flux and dose output.

= 2 for no flux output.

Tape Requirements

10 Input

9 Output

1 to N RENUPAK flux tapes.

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