

16. *References:*

¹G. D. SEYBOLD, "GSSLRN-I: An Automated Least-Squares Computer Code for the Analysis of Photopeak Spectra," USAEC Report, BNWL-1227, Pacific Northwest Laboratory (1969).

²BERNARD H. DUANE, "Maximum Likelihood Non-linear Correlated Fields (BNW Program LIKELY)," USAEC Report, BNWL-390, Pacific Northwest Laboratory (1967).

G. D. Seybold

Reactor Physics Department
Battelle Northwest Laboratory
P. O. Box 999
Richland, Washington 99352

Received April 15, 1970

RICE

1. Name of Code: RICE
2. Computer for Which Code is Designed: RICE is written to operate on computers in the IBM-360 series.
3. Problems Solved: The program calculates an energy exchange matrix which describes the probability that a neutron with energy E will produce a recoil atom with energy T in a given material. In addition, the program can calculate the primary recoil atom energy spectrum for a given neutron spectrum, the damage cross section for the material, and an optimum lower energy limit for use in comparing the relative damage in different reactor spectra. The program accepts neutron scattering data directly from the ENDF/B library tapes and, in the case of a resonance nuclide, from a tape generated by the program SUPERTOOG.
4. Method of Solution: The energy transfer matrix is obtained from a solution of the two body kinematic equations. The solution incorporates information on anisotropic elastic scattering and inelastic scattering available from ENDF/B. Damage cross sections and primary recoil spectra are obtained by combining the energy transfer matrix with suitable secondary displacement models and neutron flux spectra.
5. Restrictions on Complexity of the Problem: RICE does not recognize all of the multiplicity of data formats allowed by ENDF/B. It is programmed to accept the most prevalent formats. These restrictions are described in detail in the program manual. In addition, the neutron energy distribution is restricted to a 99-group representation and the recoil energies are represented by 200 energy groups.
6. Typical Machine Time: Running time on the IBM 360/75 for one element with all options requested is approximately 10 min.
7. Unusual Features of the Program: The inclusion of inelastic scattering in the calculation of recoil spectra and the ability to work directly from ENDF/B format tapes are both features previously unavailable in this type of program.
8. Related and Auxiliary Programs: RICE lacks the capability of calculating elastic scattering cross sections from resonance parameters. The code SUPERTOOG (ORNL-TM-2679) can be used to produce smooth elastic scattering cross sections for RICE in cases where resonance parameters are included in the ENDF/B data. The multigroup programs GAM-II, ANISN, and XSDRN can be used to produce neutron spectra for use in RICE.
9. Status: RICE is in production use on the IBM 360/75 and 360/91 at the ORNL Computing Center.
10. Machine Requirements: Approximately 110 000 words of core storage and five I/O devices excluding input-output and system requirements are needed by the program. A plotting routine makes use of ORNL system subroutines and a Calcomp CTR plotter.
11. Programming Language Used: The program is written in FORTRAN IV.
12. Operating System: IBM OS/360 with the FORTRAN H compiler.
13. Programming Information: The program presently consists of about 3000 FORTRAN statements in 45 subroutines.
14. Users Information: The code and report may be obtained either through the Argonne Code Center at Argonne National Laboratory or through the Radiation Shielding Information Center (RSIC) at Oak Ridge National Laboratory.
15. *Acknowledgment:* This research was sponsored by the U.S. Atomic Energy Commission under contract with the Union Carbide Corporation.
16. *Reference:*
J. D. JENKINS, "RICE: A Program to Calculate Primary Recoil Atom Spectra from ENDF/B Data," ORNL-TM-2706, Oak Ridge National Laboratory (1970).

J. D. Jenkins

Oak Ridge National Laboratory
Oak Ridge, Tennessee 37840
April 10, 1970

Received March 4, 1970

Revised April 8, 1970