AEC-NASA TECH BRIEF

AEC-NASA Tech Briefs describe innovations resulting from the research and development program of the U.S. AEC or from AEC-NASA interagency efforts. They are issued to encourage commercial application. Tech Briefs are published by NASA and may be purchased, at 15 cents each, from the Clearinghouse for Federal Scientific and Technical Information, Springfield, Virginia 22151.

Computer Program VARI-QUIR III Provides Solution of Steady-State, Multigroup, Two-Dimensional Neutron Diffusion Equations

The problem:

To design a computer program to solve the steady-state, multigroup, two-dimensional neutron diffusion equations in X–Y, R–Z, and R–θ geometries. In nuclear reactions having complex geometries it is necessary to calculate the neutron flux as a function of energy and of the spatial coordinates. Economic one-dimensional (slabs, cylinders, spheres) programs are in use and several two-dimensional programs have been developed. Among the two-dimensional programs, the PDQ and CURE codes are the most popular. However, both of these codes consume large amounts of computer time.

The solution:

A Gauss–Seidel type of solution with inner and outer iterations. The source is held constant during the inner iterations.

How it's done:

Although the running time for this new program (VARI-QUIR III) is approximately one-tenth that required for the CURE code, results compare favorably. The saving in computer time is accomplished through the use of a variational approximation. The program has no restrictions (within reason) on any of the input parameters such as the number of groups, regions, or materials. The parameters are restricted only by a maximum amount of storage and are completely arbitrary at execution time. The program will handle X–Y, R–Z, and R–θ geometries. A double interpolation subroutine is required to operate the code and this routine is furnished with the program deck.

Notes:

1. The program is written in Fortran IV for the IBM 7094 computer (32K memory).
2. Inquiries concerning this program may be directed to:

   COSMIC
   Computer Center
   University of Georgia
   Athens, Georgia 30601
   Reference: B67-10345

Patent status:

No patent action is contemplated by NASA.

Source: George Collier
of Westinghouse Astronuclear Laboratory
under contract to
AEC–NASA Space Nuclear Propulsion Office
(NUC-10052)

Category 06