AEC-NASA TECH BRIEF

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
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