NUCLEAR SCIENCE AND ENGINEERING: 24, 97 (1966)

Computer Code Abstract

ASSAULT*

1. Name of Code: ASSAULT[1]
2. Computer for Which Code is Designed: IBM 7090
3. Nature of Problem Solved: Multigroup, 2D, reactor depletion. Given nuclide concentrations and microscopic cross sections, the steady-state multiregion multigroup diffusion equations are solved in one or two dimensions over a finite-difference system of mesh points. The calculated neutron fluxes are then used to determine nuclide concentrations after a specified period of exposure. These calculations are repeated for a specified number of time steps.
4. Method of Solution: The code EXTERMINATOR[2] was adapted for use in ASSAULT to do the flux-eigenvalue calculation. A general explicit calculation of nuclide concentrations with flux exposure is used to solve the nuclide chain equations.
5. Restrictions on the Complexity of the Problem: For a problem that has I rows and J columns in the mesh, K energy groups, M materials of different compositions, N nuclides, X nuclides with cross sections (excludes pure decay nuclides that are not included on the cross-section library tapes), D cycles delay in fuel recycle, and U fuel makeup regions, then:

$$3 \leq I \leq 250$$
$$3 \leq J \leq 250$$
$$1 \leq K \leq 50$$
$$1 \leq M \leq 400$$
$$1 \leq N \leq 200$$
$$9 \leq (IJ) \leq 20\,000$$
$$3 \leq (IK) \leq 2000$$
$$18 \leq [J(5 + K)] \leq 2000$$
$$1 \leq (KM) \leq 800$$
$$1 \leq (K^2M) \leq 10\,000$$
$$1 \leq [N(M + D + U) + 2XK] \leq 14\,000.$$

6. Typical Running Time: A representative one-dimensional single-core depletion problem requires about one hour of machine time, and a two-dimensional problem requires six hours or more. An 8-group 648-mesh-point problem required 7.2 h for 20 time steps.
7. Unusual Features of the Program:
   A) XY, RZ, or $R\theta$ geometry may be considered.
   B) Scattering from any group to any other group is allowed.
   C) Criticality may be satisfied by direct search on a group- and region-dependent poison (which normally requires no extra machine time) or by a double iteration search on fuel or moderator mixture.
   D) Nuclide chains are specified by the user. There is provision to consider interlocked chains, partial-capture chain routes, and high-energy $(n,2n)$ product chain routes.
   E) Nuclide concentrations may be changed, material added or removed, and/or material interchanged within the reactor core at any time. Provision is made for recycle, taking into account several cycles, and holdup of material outside the reactor may be considered.
   F) The calculation of a reactor may be controlled manually at the computer console, if desired, through the use of sense switches, the on-line printer, and the input tape. For example, by following k-effective for each time step, criticality could be maintained by material interchanges (control of the input data tape) at appropriate time steps.
   G) Fuel-cycle costs can be calculated.
8. Related and Auxiliary Programs: The microscopic cross-section tape that ASSAULT uses is normally made by the code TONG[3].
9. Status: In use.
10. *References:*
    1. D. R. Vondy, T. B. Fowler and M. L. Tobias, "Reactor Depletion Code ASSAULT (Two-Dimensional, Multi-Neutron-Group)," USAEC Report ORNL-TM 1302 to be published, Oak Ridge National Laboratory.
    2. T. B. Fowler, M. L. Tobias and D. R. Vondy, "EXTERMINATOR—A Multigroup Code for Solving Neutron Diffusion Equation in One and Two Dimensions," USAEC Report ORNL-TM-842, Oak Ridge National Laboratory, (February 1965).
    3. D. R. Vondy and T. B. Fowler, "Computer Code TONG for Zero-Dimensional Reactor Depletion Calculations," USAEC Report ORNL-TM to be published, Oak Ridge National Laboratory.
11. Machine Requirements: IBM 7090 with 32K core, on-line printer, and a minimum of seven tape units on channel A (including system tape, input tape, and output tape), and seven tape units on channel B.
12. Programming Language Used: FORTRAN-2 with FAP tape I/O routines.
13. Monitor System: ASSAULT was programmed to run under control of the FORTRAN-2, Version-2 Monitor System designated IBM-709F0-062.
14. Programming Information: This code consists of 12 chain links comprising ≈8000 source statements.

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Received August 16, 1965

*Research sponsored by the USAEC under contract with the Union Carbide Corporation.