Computer Code Abstracts

BURNER

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1. Program Identification: BURNER is a code module for exposure calculations.
2. Function: This code[1,2] is designed to solve the nuclide chain equations to estimate the nuclide concentrations at the end of an exposure time and also after a shutdown period in a compatible code system.
3. Method of Solution: The explicit chain equation solution is cast in a general form for application. Alternatively, by user option, either a difference formulation using average generation rates or the matrix exponential approach may be applied, with selected chains also treated explicitly. Given the necessary cross sections—(n,γ), (n,α), $(n,2n)$, (n,p), (n,d), (n,t), and (n,f)—transmutation products may be determined, and fission product yield fractions may be incident-energy dependent. Nuclides at both a zone and a subzone level are exposed to the zone-average flux. The usual fixed fuel model is treated, as is a steady-state continuous fueling model. There is a provision for a fine-scale exposure to be calculated within selected zones, and the gamma source and cumulated exposure information may be obtained.
4. Related Material: Code blocks satisfying the basic requirements of the U.S. Department of Energy reactor physics code coordination effort will interface with this module by way of defined external data files.[3]
5. Restrictions: Data arrays are variably dimensioned and allocated disk space only as necessary for effective application to a wide range of problems, with a reasonable use of memory.
6. Computer: This code has been run on IBM computer models 360/75, 91, and 195.
7. Running Time: The computation time varies approximately as the number of depleting zones and as the square of the number of nuclides in a zone. For typical production type problems for which each zone contains a number of mesh points, the exposure calculation for a modest number of nuclides is trivial compared with that required for solution of the neutron flux problem.
8. Programming Languages: FORTRAN language is used with a few extensions to that presented in Ref. 4, especially in the service routines. The source deck contains ~24 000 cards.
9. Operating System: The OS-360 IBM operating system is used under the front end processor, HASP, with a FORTRAN IV, H-level compiler version 21.8, not extended.
10. Machine Requirements: A 64 000 word core is needed, and preferably considerably more for usual application. (Total requirements are usually governed by the neutronics code used.) Auxiliary disk storage is required for up to ten sequential scratch files and four direct access scratch files.
11. Material Available: FORTRAN source deck card images and documentation are available to domestic users from the National Energy Software Center at the Argonne National Laboratory.
12. *References*:

[1]D. R. VONDY and G. W. CUNNINGHAM, "Exposure Calculation Code Module for Reactor Core Analysis: BURNER," ORNL-5180, Oak Ridge National Laboratory (1979).

[2]D. R. VONDY et al., "A Computation System for Nuclear Reactor Core Analysis," ORNL-5158, Oak Ridge National Laboratory (1976).

[3]G. E. BOSLER et al., "LASIP-III, A Generalized Processor for Standard Interface Files," LA-6280-MS, Los Alamos Scientific Laboratory (1976).

[4]American National Standard, "FORTRAN," ANSI X3.9-1966, American National Standards Institute, New York (1966).

PERTUBAT

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1. Program Identification: Perturbation Code Module: PERTUBAT.

2. Function: This code[1] performs first-order perturbation calculations. Provision has been made to calculate perturbations due to changes in microscopic cross sections and nuclide densities. Perturbations due to a linear dependence of macroscopic cross sections on temperature may be obtained given temperature distributions and associated cross-section data. Nuclide importance data may be calculated.

3. Method of Solution: Numerical integration.

4. Related Material: Standard interface data files adopted in the U.S. Department of Energy reactor physics code coordination effort are used. User input data must be processed externally. Other modules using consistent formulations and interface data file specifications will couple directly with this one.

5. Restrictions: Variable dimensioning is used throughout. Three data-handling modes are programmed, the choice of which depends on the amount of core storage available. (This is not a stand-alone code; it must be implemented in a modular environment.)

6. Compter: This code has been run on IBM model 360 computers.

7. Running Time: Required time depends on the problem to be solved and the mode of data handling. Since the calculations performed are noniterative, the required central processor unit time is small compared with that required to solve neutronics problems.

8. Programming Languages: Most of the programming is in FORTRAN language. Known limitations of manufacturer's current compilers are not exceeded. Special routines programmed in IBM assembler language are used for certain functions, e.g., memory allocation.

9. Operating System: The basic OS-360 IBM operating system has been used under the front end processors HASP and ASP with a FORTRAN IV, H-level complier version 21.8.

10. Machine Requirements: A 50 000 short word or larger memory is required in addition to auxiliary disk storage. Typically, 30 logical I/O units are used.

11. Material Available: FORTRAN source deck card images and documentation are available to domestic users from the National Energy Software Center at the Argonne National Laboratory.

12. *Reference*:

[1]D. R. VONDY and T. B. FOWLER, "The Code PERTUBAT for Processing Neutron Diffusion Theory Neutronics Results for Perturbation Analyses," ORNL-5376, Oak Ridge National Laboratory (1978).

RODMOD

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1. Program Identification: Control Rod Positioning Code: RODMOD.

2. Function: This code[1] may be used to position control rods during the calculation of a reactor history. Provision has been made to treat the control rod follower explicitly or to apply a fractional rod insertion. Control rods may be represented by the "black absorber" boundary condition. Full rod insertion may be treated, as well as shutdown rod insertion, and then removal may be accounted for.

3. Method of Solution: Data processing.

4. Related Material: Standard interface data files adopted in the U.S. Department of Energy reactor physics code coordination effort are used. User input data must be processed externally. Other modules using consistent formulations and interface data file specifications will couple directly with this one.

5. Restrictions: Variable dimensioning is used throughout. (This is not a stand-alone code; it must be implemented in a modular environment.)

6. Computer: This code has been run on IBM model 360 computers.

7. Running Time: Trivial compared with that for solving neutronics problems.

8. Programming Languages: Most of the programming is in FORTRAN language. Known limitations of manufacturer's current compilers are not exceeded. Special routines programmed in IBM assembler language are used for certain functions, e.g., memory allocation.

9. Operating System: The basic OS-360 IBM operating system has been used under the front end processors HASP and ASP with a FORTRAN IV, H-level compiler version 21.8.

10. Machine Requirements: For use with the VENTURE modular code system, a 50 000 short word or larger memory is required in addition to auxiliary disk storage.

11. Material Available: FORTRAN source deck card images and documentation are available to domestic users from the National Energy Software Center at the Argonne National Laboratory.

12. *Reference*:

[1]D. R. VONDY and T. B. FOWLER, "RODMOD–A Code for Control Rod Positioning," ORNL-5466, Oak Ridge National Laboratory (1978).