Computer Code Abstracts

3DB

A Three-Dimensional Diffusion Theory Burnup Code

1. Name of Code: 3DB.[1]
2. Computer for Which Code is Designed: UNIVAC 1108. Programming Language: FORTRAN-IV.
3. Nature of Code: 3DB is a three-dimensional (X-Y-Z, R-θ-Z, triangular-Z) multigroup diffusion code for use in detailed fast-reactor criticality and burnup analysis. The code can be used to:
   a. compute k_{eff} and perform criticality searches on time absorption, reactor composition, and reactor dimensions by means of either a flux or an adjoint model
   b. compute material burnup using a flexible material shuffling scheme
   c. compute flux distributions for an arbitrary extraneous source.
4. Method of Solution: Eigenvalues are computed by standard source-iteration techniques. Group rebalancing and successive over-relaxation with line inversion are used to accelerate convergence. Adjoint solutions are obtained by inverting the input data and redefining the source terms. Material burnup is by reactor zone. The burnup rate is determined by the zone and energy-averaged cross sections which are recomputed after each time-step. The isotopic chains, which can contain any number of isotopes, are formed by the user. The code does not contain built-in or internal chains.
5. Restrictions on Complexity: Since variable dimensioning is employed, no simple bounds can be stated.
6. Running Time: A k_{eff} calculation with a $20 \times 20 \times 20$ mesh using 2 energy groups requires ~30 min on a UNIVAC 1108. Each successive burnup time-step takes $\sim\frac{1}{4}$ of the above time.
7. Unusual Features: The input data are arranged so the code can be used easily for k_{eff} and search calculations without burdening the user with burnup parameters.
8. Related and Auxiliary Programs: The format of the input data (e.g., cross sections, geometry and composition specifications) is compatible with the one- and two-dimensional transport codes DTF-IV[2] and 2DF,[3] the perturbation code PERT-V,[4] the one-dimensional cross-section generating code 1DX,[5] and the two-dimensional diffusion-burnup code 2DB.[6] All six codes use the same input module.
9. Status: In use.
10. Machine Requirements: A 65k memory and 11 peripheral storage devices.
11. Material Available: A source deck, sample problem, and operation instructions including a copy of Ref. 1, are available from the authors.
12. *Acknowledgment*: This paper is based on work performed under U.S. Atomic Energy Commission Contract AT(45-1)-1830.
13. *References*:

[1]R. W. HARDIE and W. W. LITTLE, Jr., "3DB, A Three-Dimensional Diffusion Theory Burnup Code," BNWL-1264, Battelle Northwest Laboratory (1970).

[2]K. D. LATHROP, "DTF-IV, A FORTRAN-IV Program for Solving the Multigroup Transport Equation with Anisotropic Scattering," LA-3373, Los Alamos Scientific Laboratory (1965).

[3]"2DF, A Two-Dimensional Transport Code," developed at the Los Alamos Scientific Laboratory, (unpublished).

[4]R. W. HARDIE and W. W. LITTLE, Jr., "PERT-V, A Two-Dimensional Perturbation Code for Fast Reactor Analysis," BNWL-1162, Battelle Northwest Laboratory (1969).

[5]R. W. HARDIE and W. W. LITTLE, Jr. "1DX, A One-Dimensional Diffusion Code for Generating Effective Nuclear Cross Sections," BNWL-954, Battelle Northwest Laboratory (1969).

[6]W. W. LITTLE, Jr. and R. W. HARDIE, "2DB User's Manual—Revision 1," BNWL-831 REV1 Battelle Northwest Laboratory (1969)

R. W. Hardie
W. W. Little, Jr.

FFTF Reactor Physics and Operations
Pacific Northwest Laboratory
Richland, Washington 99352

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FARED

1. Name of Code: FARED—A One-Dimensional Fast Reactor Physics Design and Analysis Code.
2. Computer for Which Code is Designed: CDC-6600
3. Nature of Physical Problem Solved: The FARED code was designed to permit a wide variety of one-dimensional fast reactor physics design calculations. Realistic physics models and free-format directive input allows the user to perform criticality, depletion,