PACKAGE ID - 000227CY00100 DIF3D

KWIC TITLE - Nodal Diffusion & Transport Theory

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LIMITATION CODE -UNL **AUDIENCE CODE -** USSO

COMPLETION DATE - 10/10/1986 **PUBLICATION DATE -** 04/02/1984

DESCRIPTION - DIF3D solves multigroup diffusion theory eigenvalue, adjoint, fixed source, and criticality (concentration, buckling, and dimension search) problems in 1, 2, and 3-space dimensions for orthogonal (rectangular or cylindrical), triangular, and hexagonal geometries. Anisotropic diffusion theory coefficients are permitted. Flux and power density maps by mesh cell and regionwise balance integrals are provided. Although primarily designed for fast reactor problems, upscattering and internal black boundary conditions are also treated.

PACKAGE CONTENTS - NESC Note; Software Abstract; ANL-82-64; ANL-83-1;

SOURCE CODE INCLUDED? - Yes

MEDIA QUANTITY - 1 CD Rom

METHOD OF SOLUTION - Mesh-centered finite-difference equations are solved by optimized iteration methods. A variant of the Chebyshev semi-iterative acceleration technique is applied to outer (fission-source) iterations, and an optimized block-successive-overrelaxation method is applied to the within-group iterations. Optimum overrelaxation factors are precomputed for each energy group prior to the initiation of the outer iterations. The forward sweep of the LU decomposition algorithm for the resulting tridiagonal matrices is computed prior to outer iteration initiation in orthogonal non-periodic geometry cases. In two-and three-dimensional hexagonal geometries the neutron diffusion equation is solved using a nodal scheme with one mesh cell (node) per hexagonal assembly. The nodal equations are derived using higher-order polynomial approximations to the spatial dependence of the flux within the hexagonal node. The final equations, which are cast in response matrix form, involve spatial moments of the node-interior flux distribution plus surface-averaged partial currents across the faces of the node. These equations are solved using a fission source iteration with coarse-mesh rebalance acceleration. In two and three-dimensional Cartesian geometries the neutron diffusion and transport equation solution methods are based on an interface-current formulation

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METHOD OF SOLUTION -(CONT) analogous to that developed for the solution of the diffusion equation in hexagonal geometry. The discretized equations in both schemes are derived by approximating the one-dimensional equations obtained via the transverse-integration procedure common to many nodal methods.

COMPUTER - CRAY1

OPERATING SYSTEMS - COS;CTSS

PROGRAMMING LANGUAGES - ANS FORTRAN X3.9-1978

SOURCE CODE AVAILABLE (Y/N) - Y

OTHER PROG/OPER SYS INFO - DIF3D adheres strictly to the Committee on Computer Code Coordination (CCCC) standards and reads and writes CCCC interface files. An optimized assembler version of the finite-difference, tridiagonal matrix solution and overrelaxation routine, SORINV, is available with the CDC and Cray versions. The Cray version employs a red/black line ordering for inner iteration sweeps on each plane in nonperiodic, orthogonal geometry, finite-difference problems. Mesh discretizations of mxn achieve vector lengths of m/2 and vector strides of 2n.

HARDWARE REQS - 100,000 words of memory are required on a Cray1 or Cray X-MP.

REFERENCES - K. L. Derstine, DIF3D: A Code to Solve One, Two, and Three-Dimensional Finite-Difference Diffusion Theory Problems, ANL-82-64, April 1984; R. D. Lawrence, The DIF3D Nodal Neutronics Option for Two and Three-Dimensional Diffusion Theory Calculations in Hexagonal Geometry, ANL-83-1, March 1983, and Errata; DIF3D-5.3, NESC No. R9861.CRA1, DIF3D-5.3 Cray Version Tape Description, National Energy Software Center Note 87-05, October 24, 1986.

ABSTRACT STATUS - Abstract first distributed June 1984. Cray1 version submitted May 1984, replaced by revised Edition B March 1986, replaced by DIF3D-5.3 October 1986.

SUBJECT CLASS CODE - CW

KEYWORDS -

- COMPUTER PROGRAM DOCUMENTATION
- D CODES
- EIGENVALUES
- MULTIGROUP THEORY
- BOUNDARY CONDITIONS
- ONE-DIMENSIONAL CALCULATIONS
- TWO-DIMENSIONAL CALCULATIONS
- THREE-DIMENSIONAL CALCULATIONS
- NEUTRON DIFFUSION EQUATION

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NEUTRON TRANSPORT
NEUTRON FLUX
FINITE DIFFERENCE METHOD
CRITICALITY
HEXAGONAL CONFIGURATION

EDB SUBJECT CATEGORIES -
990200 220100 663610

SPONSOR - DOE/NE

PACKAGE TYPE - SCREENED