

PACKAGE ID - 000231SUN0000 TOPAZ3D*

KWIC TITLE - 3-D Finite Element Heat Transfer

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

COMPLETION DATE - 04/01/1990 **PUBLICATION DATE** - 02/24/1992

DESCRIPTION - TOPAZ3D is a three-dimensional implicit finite element computer code for heat transfer analysis. TOPAZ3D can be used to solve for the steady-state or transient temperature field on three-dimensional geometries. Material properties may be temperature-dependent and either isotropic or orthotropic. A variety of time-dependent and temperature-dependent boundary conditions can be specified including temperature, flux, convection, and radiation. By implementing the user subroutine feature, users can model chemical reaction kinetics and allow for any type of functional representation of boundary conditions and internal heat generation. TOPAZ3D can solve problems of diffuse and specular band radiation in an enclosure coupled with conduction in the material surrounding the enclosure. Additional features include thermal contact resistance across an interface, bulk fluids, phase change, and energy balances.

PACKAGE CONTENTS - Media Directory; Software Abstract; UCID-20484;

SOURCE CODE INCLUDED? - Yes

MEDIA QUANTITY - 1 CD Rom

METHOD OF SOLUTION - TOPAZ3D solves the differential equation of heat conduction in a three-dimensional solid by the finite element method. TOPAZ3D uses an eight-node trilinear hexahedral element for spatial discretization of the geometry. The hexahedral element can degenerate to a six-node triangular prism and a four-node tetrahedron. These elements are integrated with a 2x2x2 Gauss quadrature rule, with temperature dependence of the properties accounted for at the Gauss point. Time integration is performed using a generalized trapezoidal method. Fixed point iteration with relaxation is used to satisfy equilibrium in nonlinear problems.

COMPUTER - SUN

OPERATING SYSTEMS - UNIX

PROGRAMMING LANGUAGES - FORTRAN 77

SOFTWARE LIMITATIONS - The bulk node features are not implemented.

SOURCE CODE AVAILABLE (Y/N) - Y

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RELATED SOFTWARE - TOPAZ3D is an extension to three dimensions of the two-dimensional heat transfer code TOPAZ2D. TOPAZ3D has no general mesh generation capability. Rows of evenly spaced nodes and rows of sequential elements may be generated. For complex zoning, the mesh generation code and preprocessor INGRID should be used. The TAURUS interactive postprocessor can be used to produce temperature contour, flux contour, temperature-time history, and various geometry plots. Thermal stresses can be calculated using the solid mechanics code NIKE3D which reads the temperature state data calculated by TOPAZ3D.

OTHER PROG/OPER SYS INFO - TOPAZ3D is a vectorized code.

REFERENCES - Arthur B. Shapiro, TOPAZ3D - A three-dimensional finite element heat transfer code, UCID-20484, August 1985.

ABSTRACT STATUS - Abstract first distributed March 1987. Cray1, DEC VAX11 version submitted January 1987. DEC VAX11 version submitted January 1987. IBM3090 version submitted March 1988, replaced April 1990 by revised Edition B submitted November 1988.

SUBJECT CLASS CODE - H

KEYWORDS -

COMPUTER PROGRAM DOCUMENTATION
T CODES
HEAT TRANSFER
THREE-DIMENSIONAL CALCULATIONS
TEMPERATURE DISTRIBUTION
FINITE ELEMENT METHOD
SOLIDS
TEMPERATURE DEPENDENCE
THERMAL CONDUCTIVITY
CHEMICAL REACTION KINETICS

EDB SUBJECT CATEGORIES -

990200 420400

SPONSOR - DOE/DP

PACKAGE TYPE - SCREENED