PACKAGE ID - 000250CY00100 NF85

KWIC TITLE - Air Dynamics of Explosions in Structures

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

COMPLETION DATE - 11/01/1989 **PUBLICATION DATE -** 03/16/1992

DESCRIPTION - NF85 is a three-dimensional numerical model for analyzing the effect of explosions on the dynamic behavior of air in structures. The explosion is modeled as a time-dependent and space-dependent source of equivalent air mass and energy. Chemical reactions can be modeled directly with a combustion-model option, and tracer particles may be used to monitor combustion-products convection by the air. The near-field region of the explosion is modeled in three-dimensional Cartesian or cylindrical geometry. Internal structures can be defined in the region to reflect shock waves and obstruct airflow. A dump/restart capability allows the movement or removal of internal structures during the transient solution. The effects of the surrounding far-field region are modeled at the three-dimensional region's external boundary by a wall surface, time-dependent and space-dependent pressure or velocity boundary conditions, and/or one-dimensional Cartesian-geometry regions attached to openings in the external boundary. Ventilation ducts, passageways, and openings to adjacent rooms can be modeled directly with one-dimensional regions, and the presence of blowers and filters can be modeled. Two postprocessors programs, EXCON and TRAP, are included which use the GRFDAT binary data file created by NF85 to generate a versatile selection of plots.

PACKAGE CONTENTS - NESC Note; Software Abstract; LA-11158-M; TRAP User's Manual;

SOURCE CODE INCLUDED? - Yes

MEDIA QUANTITY - 1 CD Rom

METHOD OF SOLUTION - The governing partial differential equations are solved in their finite difference form using a semi-implicit differencing method. An internal procedure automatically adjusts the time-step size based on the rate of change of the transient solution. The time-step size can be increased beyond the sonic limit to the material-Courant limit using the semi-implicit method. For time steps exceeding 80% of the material-Courant limit the stability- enhancing two-step (SETS) method is applied in addition to the semi-implicit method to allow time steps that exceed the material-Courant limit to be used. Attachment of one-dimensional regions to the three-dimensional region's external boundary is modeled by one-dimensional gas dynamics equations having full

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METHOD OF SOLUTION -(CONT) semi-implicit and SETS coupling to the three-dimensional equations.

COMPUTER - CRAY1

OPERATING SYSTEMS - CTSS

PROGRAMMING LANGUAGES - FORTRAN IV (Cray CFT)

SOURCE CODE AVAILABLE (Y/N) - Y

UNIQUE FEATURES - There is no numerical stability restriction on time-step size because the semi-implicit and SETS methods are used to solve the gas dynamics equations.

RELATED SOFTWARE - NF85 can edit interface conditions as tabular functions of time for use as boundary conditions in the EVENT84 code, which evaluates gas dynamic transients in one-dimensional flow networks. NF85 was developed from SETS3D, a test program by Susan Woodruff and John Mahaffy that implemented the semi-implicit fluid dynamics solution algorithm and stability-enhancing two-step method developed.

OTHER PROG/OPER SYS INFO - The auxiliary program, TRAP, uses the proprietary CA-DISSPLA graphics software and the Los Alamos Common Graphics System, CGS , which are not included. NF85 calls several SLATEC3.1 and LINPACK routines. These routines are included.

HARDWARE REQS - Up to 5 units besides the standard input/output units are used. Most problems require a minimum of 250,000 words of memory.

TIME REQUIREMENTS - Running time is highly problem-dependent and is a function of the number of mesh cells in the three-dimensional region and the dynamic nature of the transient. Typical running time on a Cray1 ranges from 1 to 2 ms per time step per three-dimensional region mesh cell. For one-dimensional region mesh cells times are generally 5% to 10% of these times.

REFERENCES - R. G. Steinke, NF85: A Three-Dimensional, Air-Dynamics Computer Code for Analyzing Explosions in Structures, LA-11158-M, December 1987; Michael R. Turner, TRAP User's Manual, Los Alamos National Laboratory internal document, received May 11, 1989\ NF85, NESC No. R9451, NF85 Tape Description and Implementation Information, National Energy Software Center Note 90-46, January 31, 1990.

ABSTRACT STATUS - Abstract first distributed January 1990. Cray1 version submitted May and November 1989.

SUBJECT CLASS CODE - H

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KEYWORDS -
COMPUTER PROGRAM DOCUMENTATION
N CODES
THREE-DIMENSIONAL CALCULATIONS
CHEMICAL EXPLOSIONS
PRESSURE EFFECTS
AIR FLOW
MECHANICAL STRUCTURES
SHOCK WAVES
EXPLOSIONS
BUILDINGS
VENTILATION
FLOW MODELS
TRANSIENTS
CHEMICAL REACTIONS
COMBUSTION PRODUCTS
CONVECTION

EDB SUBJECT CATEGORIES -
990200 450100 420400

SPONSOR - DOE/EH

PACKAGE TYPE - SCREENED