

PACKAGE ID - 000198DVX1100 FEM3

KWIC TITLE - Heavy Gas Dispersion Incompressible Flow

AUTHORS - Chan, S.T.
Lawrence Livermore National Lab., CA (United States)

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

COMPLETION DATE - 10/01/1986 **PUBLICATION DATE** - 12/01/1983

DESCRIPTION - FEM3 is a numerical model developed primarily to simulate heavy gas dispersion in the atmosphere, such as the gravitational spread and vapor dispersion that result from an accidental spill of liquefied natural gas (LNG). FEM3 solves both two and three-dimensional problems and, in addition to the generalized anelastic formulation, includes options to use either the Boussinesq approximation or an isothermal assumption, when appropriate. The FEM3 model is composed of three parts: a preprocessor PREFEM3, the main code FEM3, and two postprocessors TESSERA and THPLOTX. The DEC VAX11 version contains an auxiliary program, POLYREAD, which reads the polyplot file created by FEM3.

PACKAGE CONTENTS - NESC Note; Software Abstract; UCRL-53397; Media Includes Source Code, Sample Problem Input and Output, Auxiliary Programs, Machine-Readable Documentation, Control Information;

SOURCE CODE INCLUDED? - Yes

MEDIA QUANTITY - 1 CD Rom

METHOD OF SOLUTION - The model is based on solving the time-dependent, multidimensional conservation equations of mass, momentum, energy, and species. A generalized anelastic approximation is employed to accommodate large density changes and yet preclude sound waves (i.e., the fluid is considered to be basically incompressible but to have variable density). A modified Galerkin finite element method with eight-node isoparametric hexahedron elements (four-node quadrilaterals in two dimensions) is used for spatial discretization, and an improved forward Euler method is employed for time integration. The discretized Poisson equation for pressure is solved by a skyline solver.

COMPUTER - DEC VAX11

OPERATING SYSTEMS - VMS

PROGRAMMING LANGUAGES - FORTRAN 77

SOURCE CODE AVAILABLE (Y/N) - Y

OTHER PROG/OPER SYS INFO - The postprocessors, used for plotting velocity vectors, contours, time histories, etc., depend heavily

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OTHER PROG/OPER SYS INFO - (CONT) on LLNL computing environment
graphics software which is not included.

TIME REQUIREMENTS - The sample problems required 1.5 and 19.5 CPU hours
on a DEC VAX11/780.

REFERENCES - Stevens T. Chan, FEM3 - A Finite Element Model for the
Simulation of Heavy Gas Dispersion and Incompressible Flow: User's
Manual, UCRL-53397, February 1983 with errata December 1983; FEM3,
NESC No. 9903.VX11, FEM3 DEC VAX11 Version Tape Description,
National Energy Software Center Note 87-45, March 3, 1987.

ABSTRACT STATUS - Abstract first distributed October 1983. DEC VAX11
version submitted January 1986, replaced July 1986, replaced
October 1986.

SUBJECT CLASS CODE - RH

KEYWORDS -

COMPUTER PROGRAM DOCUMENTATION
EARTH ATMOSPHERE
FUEL GAS
INCOMPRESSIBLE FLOW
FINITE ELEMENT METHOD
FLUIDS
HYDRODYNAMICS
NAVIER-STOKES EQUATIONS
LIQUEFIED NATURAL GAS
GAS SPILLS
GASEOUS DIFFUSION
F CODES

EDB SUBJECT CATEGORIES -

990200 030800 540120 420400

SPONSOR - DOE/EH

PACKAGE TYPE - AS - IS