

PACKAGE ID - 000232CY00100 NASA-VOF3D

KWIC TITLE - Incompressible Flows Free Surfaces

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

COMPLETION DATE - 12/08/1987 **PUBLICATION DATE** - 03/16/1992

DESCRIPTION - NASA-VOF3D is a three-dimensional, transient, free surface, incompressible fluid dynamics program. It is specifically designed to calculate confined flows in a low gravity environment in which surface physics must be accurately treated. It allows multiple free surfaces with surface tension and wall adhesion and includes a partial cell treatment that allows curved boundaries and internal obstacles. Variable mesh spacing is permitted in all three coordinate directions. Boundary conditions available are rigid free-slip wall, rigid no-slip wall, continuative, periodic, and specified pressure outflow boundary.

PACKAGE CONTENTS - Nesc Note; Software Abstract; LA-11009-MS;

SOURCE CODE INCLUDED? - Yes

MEDIA QUANTITY - 1 CD Rom

METHOD OF SOLUTION - NASA-VOF3D simulates incompressible flows with free surfaces using the volume-of-fluid (VOF) algorithm. This technique is based on the use of donor-acceptor differencing to track the free surface across an Eulerian grid. The free surfaces are treated by introducing a function defined to be unity at any point occupied by the fluid and zero elsewhere. The complete Navier-Stokes equations for an incompressible fluid are solved by finite differences with surface tension effects included. Wall adhesion may be included or neglected as a user option. The pressures (and velocities) are advanced in time throughout the computing mesh by either a conjugate residual method or the successive overrelaxation (SOR) method. The conjugate residual method is vectorized for the Cray and uses a scaled coefficient matrix.

COMPUTER - CRAY1

OPERATING SYSTEMS - MACHINE DEPENDENT

PROGRAMMING LANGUAGES - FORTRAN

SOFTWARE LIMITATIONS - NASA-VOF3D is restricted to cylindrical coordinate representation of the geometry. A three-dimensional wall-adhesion procedure is available only for straight-walled containers.

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SOFTWARE LIMITATIONS - (CONT)

SOURCE CODE AVAILABLE (Y/N) - Y

UNIQUE FEATURES - NASA-VOF3D is highly structured so that individual components may be easily modified to fit specific problem requirements or to accept subsequent code upgrades.

RELATED SOFTWARE - NASA-VOF3D is a three-dimensional successor to NASA-VOF2D; however, its origin and architecture are most directly related to SOLA-3D.

OTHER PROG/OPER SYS INFO - NASA-VOF3D contains calls to several environment-dependent routines, including graphics systems. These routines are not included, and users must substitute the appropriate routines for their computing environment. While many problems can be run using NASA-VOF3D without code modification, specific applications may require logic changes which can be accomplished by using the UPDATE utility.

HARDWARE REQS - 4 units in addition to the standard input/output units

REFERENCES - Martin D. Torrey, Raymond C. Mjolsness, and Leland R. Stein, NASA-VOF3D: A Three-Dimensional Computer Program for Incompressible Flows with Free Surfaces, LA-11009-MS, July 1987; NASA-VOF3D, NESC No. 9568, NASA-VOF3D Tape Description and Implementation Information, National Energy Software Center Note 88-25, December 7, 1987\ Martin D. Torrey, Lawrence D. Cloutman, Raymond C. Mjolsness, and C.W. Hirt, NASA-VOF2D: A Computer Program for Incompressible Flows with Free Surfaces, LA-10612-MS, December 1985; B. Nichols, C.W. Hirt, and R.S. Hotchkiss, SOLA-VOF: A Solution Algorithm for Transient Fluid Flow with Multiple Free Boundaries, LA-8355, August 1980.

ABSTRACT STATUS - Abstract first distributed December 1987. Cray1 version submitted September 1987. Sample problem executed by NEADB January 1992 on a DEC VAX 8810.

SUBJECT CLASS CODE - H

KEYWORDS -

COMPUTER PROGRAM DOCUMENTATION
N CODES
INCOMPRESSIBLE FLOW
THREE-DIMENSIONAL CALCULATIONS
SURFACES
FLUID FLOW
SURFACE TENSION
NAVIER-STOKES EQUATIONS
ADHESION
FINITE DIFFERENCE METHOD

EDB SUBJECT CATEGORIES -

990200 420400 665000

E S T S C
ENERGY SCIENCE & TECHNOLOGY SOFTWARE CENTER
SOFTWARE ABSTRACT

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SPONSOR - DOE/FE

PACKAGE TYPE - TESTED