PACKAGE ID - 000463C760000 LDEF-SS

KWIC TITLE - Two-Phase Fluid Flow in Spray Dryers

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

COMPLETION DATE - 10/01/1985 **PUBLICATION DATE -** 10/01/1985

DESCRIPTION - LDEF-SS solves the equations for the two-phase fluid flow in spray dryers. It calculates, by a particle method, the dynamics and vaporization of a single component liquid spray. The spray is fully-coupled to a two-component gas, consisting of an inert species and the vapor of the liquid. The effects of drop collisions and coalescence are included. The geometry is spatially two-dimensional and axisymmetric, and swirling motion is permitted about the dryer axis. A wide variety of dryer parameters, such as dryer size and geometry and atomizer size and speed, and operating conditions, such as gas-flow rates and temperatures, can be specified by user-supplied parameters. Program output includes contour, vector, and spray plots, supplemented by numerical results.

PACKAGE CONTENTS - NESC Note; Software Abstract; LA-9423-MS;

SOURCE CODE INCLUDED? - Yes

MEDIA QUANTITY - 1 Mag Tape

METHOD OF SOLUTION - The equations for a single-component liquid moving and evaporating in a two-component gas composed of air and the vapor of the liquid are solved by finite-difference methods. LDEF-SS incorporates the basic methodology of the stochastic parcel (SP) method, as well as many other features of the numerical solution procedure of Dukowicz, in conjunction with the Implicit Continuous-fluid Eulerian (ICE) method. An algorithm was added to calculate the effects of drop collisions. The ordinary differential equations governing the changes in drop properties are approximated by first-order methods. The finite-difference equations for the gas-phase properties are obtained by a control-volume derivation. An eddy diffusivity approximation is used to calculate the turbulent transport of mass, momentum, and energy in the gas.

COMPUTER - CDC7600

OPERATING SYSTEMS - LTSS (CDC7600); NOS 1.4 (CDC CYBER175);

PROGRAMMING LANGUAGES - FORTRAN 77

SOFTWARE LIMITATIONS - LDEF-SS does not calculate the gas-phase transport of sulfur dioxide and its dissolution and reaction with the liquid.

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SOFTWARE LIMITATIONS -(CONT)
SOURCE CODE AVAILABLE (Y/N) - Y

OTHER PROG/OPER SYS INFO - Due to the iterative nature of the calculations in LDEF-SS, machine round-off error may produce slightly different results on different machines. For the CDC version, the FORTRAN compiler option, ROUND, should be invoked to duplicate the sample problem output. This version includes NESC-provided dummy routines for the LANL Stromberg-Carlson plotter routines: ADV, DRV. GPLOT, GRPHFTN, GRPHLUN, LIB4020, LINCNT, PLT, and SETFLSH, which should be replaced with suitable alternatives for the environment in which the program is being executed to obtain graphical output.

HARDWARE REQS - 127,000 (octal) words of memory are required to execute the sample problem on a CDC CYBER175.

TIME REQUIREMENTS - NESC executed the sample problem in 36 CP minutes on a CDC CYBER175.

REFERENCES - Peter J. O'Rourke and Willard R. Wadt, A Two-Dimensional, Two-Phase Numerical Model for Spray Dryers, LA-9423-MS, July 1982; LDEF-SS, NESC No. 1027.7600B, LDEF-SS CDC Version Tape Description and Implementation Information, National Energy Software Center Note 86-03, October 25, 1985\ Gail Rein, J501 SC-4020 Emulation, User Manual, LANL PIM-2 Program Library Write-Up, May 1981; John K. Dukowicz, A Particle-Fluid Numerical Model for Liquid Sprays, Journal of Computational Physics, Vol. 35, No. 2, pp. 229-253, April 1980.

ABSTRACT STATUS - Abstract first distributed August 1983. CDC7600 version submitted September 1982, replaced October 1985 by revised Edition B, sample problem, without plotting, executed by NESC March 1983 on a CDC CYBER175.

SUBJECT CLASS CODE - HT

KEYWORDS -
COMPUTER PROGRAM DOCUMENTATION
L CODES
TWO-PHASE FLOW
SPRAY DRYING
FOSSIL-FUEL POWER PLANTS
DESULFURIZATION
FLUE GAS
FLUID FLOW
PARTICLES
FINITE DIFFERENCE METHOD

EDB SUBJECT CATEGORIES -
990200 010800 010300 420400

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SPONSOR - DOE/ER

PACKAGE TYPE - AS - IS