PACKAGE ID - 000233IBMPC00 MGMHD

KWIC TITLE - Multigrid 3-D Magnetohydrodynamics

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

COMPLETION DATE - 01/01/1990 **PUBLICATION DATE -** 02/19/1992

DESCRIPTION - MGMHD is a three-dimensional code for the analysis of magnetohydrodynamic (MHD) channels (generators, diffusers, and thrusters) for compressible and incompressible, laminar and turbulent, iso- and noniso-thermal fluids.

PACKAGE CONTENTS - Media Directory; NESC Note; Software Abstract; ANL/MHD-89/1; Media Includes Source Code, Sample Problem, and Machine Readable Documentation;

SOURCE CODE INCLUDED? - Yes

MEDIA QUANTITY - 1 5.25 Diskette

METHOD OF SOLUTION - The MHD equation set comprises the mass continuity equation, three momentum equations, the energy equation, two turbulence equations, and Maxwell's electrical equation. The two-equation turbulence model equations are solved for the turbulence energy and its dissipation rate. MGMHD employs the classical semi-implicit method for pressure-linked equations (SIMPLE) parabolic marching technique in the axial direction. The cross-stream plane continuity and elliptic momentum equations are solved simultaneously by the full approximate storage (FAS), block implicit multigrid method (BLIMM). The cross-stream elliptic potential equations are solved using an FAS multigrid procedure. The finite-difference equations are obtained by integrating the differential equations over the transformed space control volumes surrounding the flow variables. The hydrodynamic finite difference equations are solved by a symmetrical coupled Gauss-Seidel procedure. A point Gauss-Seidel procedure is used to smooth the electric potential, axial momentum, energy, and turbulence finite-difference equations.

COMPUTER - IBM PC

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OPERATING SYSTEMS - DOS

PROGRAMMING LANGUAGES - Microsoft FORTRAN

SOFTWARE LIMITATIONS - A variety of inlet conditions can be prescribed, but the inlet axial velocity must be positive to avoid any inconsistency with the parabolic treatment of the gas dynamic equations. For some problems, the viscous dissipation near the walls may be quite large, especially for high speed flows, and lead to numerical instabilities.

SOURCE CODE AVAILABLE (Y/N) - Y

RELATED SOFTWARE - MGMHD is an updated and improved version of the single grid, three-dimensional magnetohydrodynamic code, TDMHD. The TDMHD formulation of the three-dimensional partial differential equations for flow and electrical fields is retained with an advanced multigrid solution algorithm incorporated.

OTHER PROG/OPER SYS INFO - Instructions for tailoring MGMHD to DEC VAX and IBM mainframe and PC/AT computers are contained in the User's Guide.

TIME REQUIREMENTS - MGMHD performs about four times faster than the earlier TDMHD code. Approximately two hours were required for a 10m diagonal channel IBM PC/AT simulation, with a DSI780 board.

REFERENCES - J. X. Bouillard, J. L. Krazinski, S. P. Vanka, and G. F. Berry, User's Manual for MGMHD: A Multigrid Three-Dimensional Computer Code for the Analysis of Magnetohydrodynamic Generators and Diffusers, ANL/MHD-89/1, November 1989\ MGMHD, NESC No. 9452, MGMHD Flexible Disk Cartridge Description and Implementation Note, National Energy Software Center Note 90-43, January 30, 1990; J. X. Bouillard, J. L. Krazinski, S. P. Vanka, and G. F. Berry, Performance of a Multigrid Three Dimensional MHD Generator Calculation Procedure, 27th Symposium Engineering Aspects of Magnetohydrodynamics, June 27-29, 1989, Reno, Nevada, pp. 5.2-1 through 5.2-12.

ABSTRACT STATUS - Abstract first distributed January 1990. IBM PC version submitted July, October, and November 1989 and January 1990.

SUBJECT CLASS CODE - HT

KEYWORDS -
COMPUTER PROGRAM DOCUMENTATION
M CODES
MHD CHANNELS
MESH GENERATION
MAGNETOHYDRODYNAMICS

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MHD GENERATORS
DIFFUSERS
THRUSTERS
FLUID FLOW

EDB SUBJECT CATEGORIES -
990200 300104

SPONSOR - DOE/PET

PACKAGE TYPE - AS - IS