ALFVEN – A TWO-DIMENSIONAL CODE BASED ON SHASTA, SOLVING THE RADIATIVE, DIFFUSIVE MHD EQUATIONS

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PROGRAM SUMMARY

Title of program: ALFVEN

Catalogue number: ABUX

<i>Computer</i>	<i>Installation</i>
CDC 6500	ACCU, Utrecht
CDC 6600	Computer Centre, Groningen
IBM 370/168	CECAM, Orsay, France
IBM 370/158	CRI, Leiden

Operating system: SCOPE 3.4 resp. OS-MVT or OS-MVS

Program language used: FORTRAN IV

High speed storage required: 55 kwords (CDC), 300 kbytes (IBM)

No. of bits in a word: 60 (CDC), 32 (IBM), single precision

Overlay structure: none

No. of magnetic tapes: none

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Other peripherals used: card reader, line printer, magnetic disks

No. of cards in combined program and test deck: 2600

Keywords: Diffusive, radiative MHD, 2-dim, second-order accuracy, explicit convection, implicit diffusion, monotonic solutions, SHASTA numerical scheme, low-diffusion scheme

Nature of physical problem

A two-dimensional computer program to be used for solving hydrodynamic and hydromagnetic equations in various geometries [1,2]. The effects of gravity, ohmic dissipation and diffusion, radiative losses and thermal conduction are included through an implicit, time-split coupled, step. The convective part of the equations is solved by the SHASTA numerical code [3–7], having second-order accuracy but guaranteeing monotonicity in the directly-convected quantities. One-dimensional and isothermal applications are possible. The program uses the equation for conservation of total energy (*U*-version).

Method of solution

Vectorized, two-dimensional explicit convection step with predictor–corrector ordering for second-order solution with removal of numerically produced extrema, time-split coupled to an implicit, tridiagonal matrix solver for physical conduction, radiation and diffusion [8].

Typical running time

Achieving equilibrium in longest physical time scale will require typically 1200 time steps. Duration of one time step (–5% for adiabatic, –25% for diffusion free calculations): 22 s (CDC 6500), 6 s (CDC 6600), 4 s (IBM 370/168), 15 s (IBM 370/158) for a 63×43 grid in single precision.

References

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