NUMERICAL SOLUTIONS OF THE MAGNETOHYDRODYNAMIC EQUATIONS FOR ONE-DIMENSIONAL Θ-PINCH GEOMETRY

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Abstract

A new Eulerian conservative (as defined by K.V. Roberts and N.C. Weiss [1]), one-dimensional difference scheme was developed. The equations for mass density, momentum magnetic field, thermal energy density of ions and electrons and the difference $p_\perp - p_\parallel$ between the components of the ion pressure tensor were solved by this scheme for a Θ-pinch geometry. In order to provide more reliable estimates of the energy fed to the plasma the scheme was made to conserve not only mass, momentum, and magnetic flux, but also energy. The "source terms" - Joule heating and compressional work - were calculated by using the differential equations for the magnetic and kinetic energy.
Machine runs were carried out with the data of the ISAR I Θ-pinch experiment at Garching. The calculated ion temperatures agree well with the measured values.

1) Mathematics of Computation, 20, 272 (1966)