A STABILIZED FINITE ELEMENT METHOD FOR MAGNETOHYDRODYNAMICS EQUATIONS

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Maxwell equations of electromagnetics and the basic equations of fluid mechanics lead to Magnetohydrodynamics (MHD) equations, a coupled system of equations in the velocity and magnetic field. The finite element solution of the problem presents difficulty for high Hartmann number M>100. A stabilized finite element method for the numerical solution of the problem is given to obtain the solution in terms of velocity and induced magnetic field. A suitable change of variables decouples the system of differential equations bringing each equation in the system to a form of advection-diffusion type. We employ the Galerkin Least Squares (GLS) type stabilized finite element method to solve the problem. Computations are carried out for several values of Hartman number M by using four node quadrilateral elements. Comparisons are made for several bencmark problems. The results for the velocity and magnetic field are illustrated by some selected graphs. Convergence rates obtained through error analysis are also proved.