

Problem 1 (2 points)

Show that the maxwell equation $\nabla \cdot \mathbf{B} = 0$ is satisfied for all times $t > t_0$ if it is satisfied for some initial time t_0 .

Problem 2 (1 point)

Nevertheless, $\nabla \cdot \mathbf{B} = 0$ is often not neglected in numerical MHD simulations. Why?

Problem 3 (3 points)

Show that $\nabla \cdot \mathbf{E} = \rho_c/\epsilon_0$ is satisfied for all times $t > t_0$ if it is satisfied for some initial time t_0 .

Problem 4 (4 points)

Consider a two-dimensional MHD plasma ($\partial/\partial z = 0$). The plasma flow is confined to the x, y plane, i.e., $u_z = 0$. Show that the z component of the magnetic field satisfies

$$\frac{d \ln B_z}{dt} = -\nabla \cdot \mathbf{u}$$

Please turn in the solutions to the homework on Monday, 10/23/06