Numerical Simulation Of The Kelvin-Helmholtz Instability

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The Kelvin-Helmoholtz instability is simulated with an Adaptive Finite Volume method applied to the analysis of large perturbations registered along the equatorial magnetopause (MP). The code is based on a complex multi-component species program with transport and radiation terms. The integration domain is represented with a structured irregular mesh, with fixed connectivity. The hydrodynamics was implemented in order to improve the computational efficiency plus the improved capability of adapting the mesh to the solution. After each calculation cycle, mesh vertices are moved arbitrary over the fluid. This is done in order to dynamically adapt the mesh to the solution. The adaptive method consists of shifting mesh vertices over the fluid in order to keep a reasonable mesh structure and increase the spatial resolution where the physical solution demands. The improved hydrodynamics method worked well in an ample range of Mach number from subsonic (10^{-3}) to supersonic. We show the results of the development of the Kelvin-Helmhotz instability in local plane slab models of the magnetopause, showing the development and saturation of the instability in an initially unperturbed structure, i.e., the temporal response approach; and the response of a background equilibrium to the excitation by finite amplitude perturbations generated upstream, i.e., the spatial response of the system.