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MHD Flow Control of Oblique Shock Induced Separation JOHN EKATERINARIS, FORTH/IACM and University of Patras — The effect of magnetic fields on the flow of conducting fluids is well known. There is current interest to exploit the body forces induced by they magnetic field for the control of separation, transition, and turbulence. The wave structure of ionized gas high speed flows under the influence of magnetic fields, which contains slow, Alfvιn, and fast waves, is more involved than the waves of ordinary gas dynamics. High resolution is required to accurately compute interactions of complex wave discontinuities and smooth flow features. Numerical solutions of the ideal and viscous magnetohydrodynamic (MHD) equations are obtained with a high order accurate shock capturing scheme. The numerical method was validated to ensure that it provides crisp resolution of discontinuities, it maintains high-order accuracy for the smooth parts of the flow, it preserves numerical stability, and eliminates nonphysical features that result from the violation of the divergence-free condition for the magnetic field. The numerical method was then applied to simulate separation control at the interaction region of an oblique shock with a laminar boundary layer under the influence of magnetic fields. It was found that magnetic fields can significantly reduce shock induced separation that appears upstream of the interaction region and can cause rapid transition to turbulence.

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