Transonic Flow and Supersonic Geometry

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This talk will outline recent work (with G-Q Chen and Dehua Wang) on existence of weak solutions for the equations of steady 2-D transonic flow over an airfoil. The main idea is to show that the program begun by Cathleen Morawetz in her CPAM 1985 paper can be extended by explicitly giving a viscous approximation to the steady transonic flow equations that yield some (but not all) of the estimates needed to apply the Tartar-Murat method of compensated compactness. Interestingly perhaps is that Gauss- Codazzi equations of classical differential geometry are very similar to the equations of steady isentropic gas dynamics and the method of compensated compactness also applies to the yield existence of weak solutions to the initial value problem for the Gauss-Codazzi equations and hence gives a family of isometric immersions of some two dimensional Riemannian manifolds into three dimensional Euclidean space.