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Effect of Large Bulk Viscosity on Two-Dimensional Transonic Flow[1] MARK CRAMER, Virginia Polytechnic Institute and State University — We examine steady two-dimensional transonic flows over a thin airfoil or turbine blade. The wing Reynolds number is taken to be large and the fluid is described by the classical Navier-Stokes equations. The bulk viscosity is taken to be large compared to the shear viscosity. We use the Method of Matched Asymptotic Expansions to give the conditions under which the effects of large bulk viscosity are no longer negligible. We show that longitudinal viscous effects must be considered at lowest order when the ratio of bulk to shear viscosity is on the order of the product of the conventional Reynolds number times the two-thirds power of the non-dimensional airfoil thickness. Under these conditions the flow is shown to be frictional, irrotational, and governed by the viscous form of the transonic small disturbance equation.

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