

AAE 519 Prof. Schneider, Fall 2011

Problem Set 3

Handed Out: Friday, 16 Sept.

Due: Friday, 23 Sept.

Study the Taylor-Maccoll problem for inviscid perfect-gas flow past a sharp round cone at zero angle of attack, and the solver that was emailed to you. Compile and run the program. Compute the shock-wave angle and surface pressure for a range of values of freestream Mach number, cone angle, and specific-heat ratio. Plot the effect of these three parameters.

Compare the results to those of hypersonic small-disturbance theory (Anderson, HHTG, 2e, section 4-6). In particular, compare the shock-angle results to equation (4.125), and compare the surface pressure coefficients to (4.126). Make plots similar to Fig. 4.8, and also see how well the exact results are scaled by the hypersonic similarity parameter. Also, compare the surface pressure to (1) the Newtonian value, and (2) the experimental data from Fig. 11a of NACA Report 1386, which was sent to you.

Present your results in the form of a brief informal report. This report should make it clear that you understand the overall problem, including the derivations presented in class.