Detached Shock Problem and Related Topics

H. M. Lieberstein
Mathematics Research Center, U. S. Army
Madison 6, Wis.

S U M M A R Y

A finite difference method for solving the Cauchy or initial value problem for elliptic partial differential equations as introduced in (1) and further developed in (2) will be the principal topic discussed here. Involved in this discussion, also, will be certain basic notions related to the (analytic) stability of such problems as developed in (2) and (3). Contributions to the theory of hypersonic flow which resulted from application of this numerical method to the inviscid portion of the flow in the nose region of a blunt nosed body (1) (2) (4) and, also, a successful attack on the related boundary layer problem using a modified Crank-Nicolson technique (5) will be described. It will be shown further that the numerical method given in (2) is useful in resolving certain scientific questions in connection with engineering design of Pierce type electron guns.

(1) P. R. Garabedian, Numerical construction of detached shock waves, J. Math. and Phys., Vol. 36, No. 3, pp. 192-205, October, 1957

(2) P. R. Garabedian and H. M. Lieberstein, On the numerical calculation of detached bow shock waves in hypersonic flow, J. Aero. Sci., Vol. 25, No. 2, pp. 109-118, February 1958

(3) H. M. Lieberstein, Singularity occurrence and stably posed problems for elliptic equations, Report #81, Mathematics Research Center, U. S. Army, Madison, Wisc.

(4) H. M. Lieberstein, Further numerical data on blunt bodies, note, J. of Aero/Space Sci. Vol. 25, No. 10, October 1958

(5) R. F. Kramer and H. M. Lieberstein, Numerical solution of the boundary layer equations without similarity assumptions, J. of Aero/Space Sci. (in print). For summary see Preprints, 13th National Meeting ACM (1958)