

Unsteady Flows Behind Hydromagnetic Shocks

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Summary. The differential effects of shock fronts on the flow and field parameters in 3-dimensional unsteady flows of conducting gases have been explicitly determined with no restriction on the magnetic field. The expressions for vorticity and current density generated by hydromagnetic shocks have been obtained and some interesting physical conclusions have been made.

1. Introduction. The problem of determining the differential effects of shock fronts on the flow variables has drawn the attention of several researchers striving for increasing generality. For plane shocks in non-conducting gases Thomas (1947) [1] developed a tensorial method to solve this problem and his results were extended by Kanwal (1958) [2, 3, 4] for 3-dimensional shocks in stationary, pseudo-stationary and unsteady flows of non-conducting gases. Ram and Mishra (1966) [5] further generalized their results for hydromagnetic shocks in 3-dimensional pseudo-stationary flows. Pant and Mishra (1965) [6] solved this problem in the case of stationary flows of conducting gases by applying a transformation of co-ordinates and obtained the expression for vorticity generated by the shock under the restriction that the magnetic field acts tangentially to the shock surface. The object of the present paper is to solve this problem in the case of unsteady flows of conducting gases with no restriction on the magnetic field.

The determination of vorticity generated by a shock has also been an interesting topic for researchers. For plane shocks in non-conducting gases Truesdell (1952) [7] concluded that *the magnitude of the vorticity generated by a shock of given strength and curvature depends only on the magnitude of the tangential component of the velocity and is independent of the form of the equation of state*. Hayes (1957) [8] observed that Truesdell's statement suggests that the result is purely dynamical and thus should be derivable without recourse to any thermodynamic law and to verify it he provided a proof based on the momentum equation alone. For plane shocks in stationary flows of conducting gases Kanwal (1960) [9] concluded that *the vorticity is no longer derivable from dynamical relations as in*