Similarity solutions for magnetogasdynamic cylindrical shock waves in a rotating non-ideal gas

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Abstract

The present paper demonstrates the analysis of cylindrical shock waves in a rotating isothermal flow of a non-ideal gas with the impact of the axial magnetic field. We obtain some special class of similarity solutions to the considered problem by using the Lie group of transformations. We assume that the density is uniform in the undisturbed medium, whereas the axial and azimuthal components of the fluid velocity and magnetic field are supposed to vary. By employing the invariant surface conditions, we obtain the generators of the Lie group of transformations. As per the choice of arbitrary constants arising in the expressions for the generators, we obtain four cases of possible solutions. Among all the cases, the similarity solutions are obtained only in three cases. The first and second cases relate to the power and exponential law shock path, respectively, while the third case shows a special case of the power-law shock path. We solve the case of the power-law shock path numerically. Behind the shock front, the distributions of flow variables are analyzed graphically to elucidate the effects of variation in values of the non-ideal parameter, Alfven-Mach number, ambient azimuthal velocity exponent and adiabatic exponent. All the computational work has been performed by using the software package "MATLAB".

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