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Propagation of one-dimensional planar and non-planar shock waves in non-ideal radiating gas

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The present study seeks to investigate a quasilinear hyperbolic system of partial differential equations (PDEs) which describes the unsteady one-dimensional motion of a shock wave of arbitrary strength propagating through a non-ideal radiating gas. We have derived an infinite hierarchy of the transport equation which is based on the kinematics of one-dimensional motion of shock front. By using the truncation approximation method, an infinite hierarchy of transport equations, which governs the shock strength and the induced discontinuities behind it, is derived to study the kinematics of the shock front. The first three transport equations (i.e., first, second and third-orders) are used to study the growth and decay behavior of shocks in van der Waals radiating gas. The decay laws for weak shock waves in non-radiating gas are entirely recovered in the second-order truncation approximation. The results obtained by the first three approximations for shock waves of arbitrary strength are compared with the results predicted by the characteristic rule. Also, the effect of non-ideal parameters and radiation on the evolutionary behavior of shock waves are discussed and depicted pictorially.

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