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STUDY OF SELF-SIMILAR PISTON PROBLEM IN TWO-PHASE RADIATING GASES

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Abstract: A differential approximation for the equation of radiative transfer in a grey gas is applied to study the effect of thermal radiation in case of one dimensional unsteady shock generated by a piston with velocity $v_p = ht^n$, in case of two-phase mixture of gas and dust particle. Numerical solutions in region between the shock and piston problem are presented for the case of general opacity and transparent limit. The influence of particle volume fraction for various cases are discussed and is concluded that though the general behaviour of velocity, density, pressure are unaffected, yet presence of particle volume fraction shows a rising tendency in velocity, density and pressure but a decreasing tendency in net radiative flux.

Keywords and Phrases: Shock Waves, piston problem, two-phase, radiation.

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1. Introduction

Effect of radiation are of great significance in astrophysical problem and nuclear explosions. On the flow field of gas, radiation effect can be expressed in terms of radiation pressure, radiation-energy density and radiation flux. In extremely high speed of flight of a space craft re-entering planetary atmosphere, radiation becomes an important mode of heat transfer and plays an important role not only in stellar-atmospheres but also in stellar-interiors. If medium is extremely rarified but extended, the energy and pressure of the radiation become comparable with those of matter and thus influences the thermodynamic properties of the medium. On account of the high temperatures that prevail in many phenomena, it is of interest to consider the effect of thermal radiation in gas-dynamics. The similarity methods of Taylor [1] and Sedov [2], well known for classical piston problems, have been extended to radiating gases by Wang [3] and Helliwell [4]. Finkleman and Baron [5] discussed the hyperbolic character of the governing equation and