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AXIALLY SYMMETRIC FLOW IN TWO SPACE DIMENSIONS FOR NONIDEAL GASES

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Abstract: We study axially symmetric Euler's system of equations for the real gas in two space dimensions. This problem poses various difficulties for arbitrary equation of state and general problem is still open. Deviation from ideal gas law generally involves change of phase and more number of chemical species. This affects number of degrees of freedom which is governed by phase rule. We analyze self-similar solutions of Euler's system of equations for the real gas (alternatively called non-ideal gas) which is in one phase but may contain vapor or moisture. We find that structure of solutions in this case is governed by fundamental derivative of underlying gas. Emergence of fundamental derivative in calculations carried out by the authors suggest that structure of solutions to Euler's equations in gas dynamics is fundamentally dependent on the thermodynamics of underlying gas. We have considered case of zero swirl in this article.

Keywords and Phrases: Euler's equations, Axially symmetric Flow, Fundamental Derivative, Mach number, Swirl, Gas dynamic Waves, Transitional Solution, Chaos.

2020 Mathematics Subject Classification: 35B07, 76N30, 34D05, 76T10.

1. Introduction

Method of characteristics is central in dealing with hyperbolic system of partial differential equations in one space dimension and widely discussed in the literature. However characteristic surfaces admitted by hyperbolic system of partial