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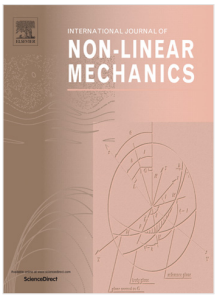

Preliminary group classification for the flow of a thermodependent fluid in porous medium

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Preliminary group classification for the flow of a thermodependent fluid in porous medium

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Abstract

In this work, we perform preliminary group classification of equations governing the flow of a thermo-dependent fluid in a porous medium. The detailed model is a coupled system of nonlinear partial differential equations containing two arbitrary functions. The principal Lie algebra admitted by the coupled system is given. The study also demonstrates that the forms of arbitrary functions provide an extension of this algebra via an optimal system of one-dimensional Lie subalgebras.

Keywords: Lie group analysis, Equivalence transformation, Preliminary group classification, Optimal system, Conformal transformation

1. Introduction

Nowadays, despite a considerable development of numerical techniques, we are moving towards an increasing use of Lie symmetry theory, mainly because of the lack of systematic methods for the search of particular analytical solutions to a partial or ordinary differential equation. Sophus Lie has made a fundamental contribution to the problem of integrating ordinary differential equations. One of the key ideas of his approach is to consider a continuous group of transformations depending on one or more parameters, acting on the space of both

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