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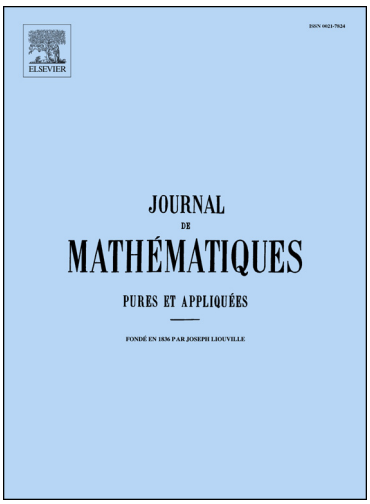

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Finite-time blow-up phenomena of Vlasov/Navier-Stokes equations and related systems

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Abstract

This paper deals with the finite-time blow-up phenomena of classical solutions for Vlasov/Navier-Stokes equations under suitable assumptions on the initial configurations. We show that a solution to the coupled kinetic-fluid system may be initially smooth, however, it can become singular in a finite period of time. We provide a simple idea of showing the finite time blow up of classical solutions to the coupled system which has not been studied so far. We also obtain analogous results for related systems, such as isentropic compressible Navier-Stokes equations, two-phase fluid equations consisting of pressureless Euler equations and Navier-Stokes equations, and thick sprays model.

Keywords: Sprays, blow-up, kinetic-fluid, multiphase flows

2010 MSC: 35M10, 35Q35, 35B44, 82C40, 82C22

1. Introduction

Sprays are complex flows which are constituted of dispersed particles such as droplets, dust, etc, in an underlying gas. A coupling of particles and gas was first proposed by Williams [1]. Later O'Rouke [2] classified the sprays depending on the volume fraction of the gas; thin sprays in which the volume occupied by the particles is negligible compared to the volume occupied by the gas, thick sprays where the volume fraction of the particles has to be considered together with

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