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# Lie symmetry approach for The Vlasov-Maxwell system of equations

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**Abstract**

The present paper is intended for the investigation of the fractional integro-differential system called Vlasov-Maxwell system. The method is based on using the geometric vector fileds of the symmetries. This system arises for interaction of charged particles in plasma. The fractional derivative is considered in both the Caputo and Riemann-Liouville sense. Under some suitable conditions, we construct the infinitesimal criterion of invariance for detecting Lie symmetries of these equations. In this study, Lie symmetry method for constructing the similarity solutions of the considered system is implemented. The theory is constructed step by step and carefully to apply in the Vlasov-Maxwell system.

*Keywords:* Fractional integro-differential equation, Fractional derivative, Lie symmetry, Invariant solution.

*2010 MSC:* 34A08, 35R11, 26A33, 58D19, 70S10.

## 1. Introduction

Fractional differential equations (FDEs) have many applications in various fields of engineering and science, for example vibration, viscoelasticity, control and electromagnetic theory. As a matter of fact, fractional derivatives provide an

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