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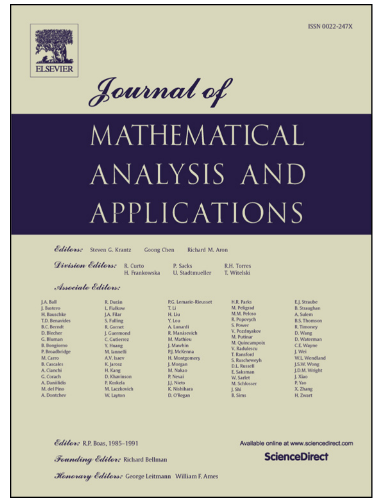

Hamilton Jacobi Isaacs equations for Differential Games with asymmetric information on probabilistic initial condition

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Hamilton Jacobi Isaacs equations for Differential Games with asymmetric information on probabilistic initial condition.

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Abstract

We investigate Hamilton Jacobi Isaacs equations associated to a two-players zero-sum differential game with incomplete information. The first player has complete information on the initial state of the game while the second player has only information of a - possibly uncountable - probabilistic nature: he knows a probability measure on the initial state. Such differential games with finite type incomplete information can be viewed as a generalization of the famous Aumann-Maschler theory for repeated games. The main goal and novelty of the present work consists in obtaining and investigating a Hamilton Jacobi Isaacs Equation satisfied by the upper and the lower values of the game. Since we obtain a uniqueness result for such Hamilton Jacobi equation, as a byproduct, this gives an alternative proof of the existence of a value of the differential game (which has been already obtained in the literature by different technics). Since the Hamilton Jacobi equat ion is natural ly stated in the space of probability measures, we use the Wasserstein distance and some tools of optimal transport theory.

Key words. Differential game; asymmetric information; Isaacs condition; continuous initial distribution; Wasserstein distance; Functional on measures.

AMS subject classifications. 49N70, 49L25, 91A23, 49Q20.

Introduction

In this paper we study a zero-sum two-players differential game where the first player has asymetric information on the initial position. The dynamics is given by

$$x'(t) = f(x(t), u(t), v(t)),\ \ u(t) \in U,\ v(t) \in V \tag{1}$$

with $f : \mathbb{R}^N \times U \times V$ and where U and V are compact subsets of some finite dimensional spaces. A payoff is given by a function $g : \mathbb{R}^N \mapsto \mathbb{R}$.