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Piecewise closed-loop equilibria in differential games with regime switching strategies*

Ngo Van Long[†], *Fabien Prieur*[‡], *Mabel Tidball*,[§] *and Klarizze Puzon*[¶]

Abstract

We propose a new methodology exploring piecewise closed-loop equilibrium strategies in differential games with regime switching actions. We develop a general game with two players. Players choose an action that influences the evolution of a state variable, and decide on the switching time from one regime to another. Compared to the optimal control problem with regime switching, necessary optimality conditions are modified for the first player to switch. When choosing her optimal switching strategy, this player considers the impact of her choice on the other player's actions and consequently on her own payoffs. In order to determine the equilibrium timing of regime changes, we derive conditions that help eliminate candidate equilibrium strategies that do not survive deviations in switching strategies. We then apply this new methodology to an exhaustible resource extraction game.

Key words: differential games; regime switching strategies; technology adoption; non-renewable resources

JEL classification: C61, C73, Q32.

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