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A passivity approach to game-theoretic CDMA power control. (English) Zbl 1222.93162

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Summary: This paper follows a game-theoretical formulation of the CDMA power control problem and develops new decentralized control algorithms that globally stabilize the desired Nash equilibrium. The novel approach is to exploit the passivity properties of the feedback loop comprising the mobiles and the base station. We first reveal an inherent passivity property in an existing gradient-type algorithm, and prove stability from the passivity theorem. We then exploit this passivity property to develop two new designs. In the first design, we extend the base station algorithm with Zames-Falb multipliers which preserve its passivity properties. In the second design, we broaden the mobile power update laws with more general, dynamic, passive controllers. These new designs may be exploited to enhance robustness and performance, as illustrated with a realistic simulation study. We then proceed to show robustness of these algorithms against time-varying channel gains.

MSC:

93C95 Application models in control theory
91A10 Noncooperative games
91A40 Other game-theoretic models
93D05 Lyapunov and other classical stabilities (Lagrange, Poisson, L^p, l^p, etc.) in control theory

Keywords:

CDMA power control; nonlinear control; passivity; game theory

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