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A Robustness Analysis of Game-Theoretic CDMA Power Control

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Abstract: This paper studies robustness of a gradient-type CDMA uplink power control algorithm with respect to disturbances and time-delays. This problem is of practical importance because unmodeled secondary interference effects from neighboring cells play the role of disturbances, and propagation delays are ubiquitous in wireless data networks. We first show L_p-stability, for p \in [1,\infity], with respect to additive disturbances. We pursue $L_{\infity}$-stability within the input-to-state stability (ISS) framework of Sontag [7], which makes explicit the vanishing effect of the initial conditions. Next, using the ISS property and a loop transformation, we prove that global asymptotic stability is preserved for sufficiently small time-delays in forward and return channels. For larger delays, we achieve global asymptotic stability by scaling down the step-size in the gradient algorithm.

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