ABSTRACT

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This study addresses the design and analysis of multivariable Extremum Seeking for static maps subject to arbitrarily long time delays. Gradient-based method is considered. Multi-input systems with different time delays in each individual input channel are dealt with. In the alternative method the phase compensation of the dither signals and the inclusion of predictor feedback with a perturbation-based (averaging-based) estimate of the Hessian allow to obtain local exponential convergence results to a small neighborhood of the optimal point, even in the presence of delays. The stability analysis is carried without using backstepping transformation, which also eliminates the complexity of the controller. In a nutshell, a simpler implementation scheme and direct analysis without invoking successive backstepping transformation can be assured. A numerical example illustrates the performance of the proposed delay-compensated extremum seeking scheme and its simplicity.

Keywords: Adaptive control; Gradient extremum seeking; Real-time optimization; Predictor feedback; Delay systems.