

REMARKS ON TIME-SCALE DECOMPOSITION USING SINGULAR PERTURBATIONS WITH APPLICATIONS

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Dedicated to Dr. Vasile Drăgan on the occasion of his 70th anniversary

Abstract

In this paper, we point out important observations on time-scale decomposition of linear singularly perturbed systems. It has been established in the control literature that the asymptotically stable fast modes of a singularly perturbed system decay rapidly in a boundary layer interval when the perturbation parameter is very small hence the slow subsystem can serve as a good approximation of the original model. We observe that while this is the case in the steady state, it is not true during the transient response for a strictly proper system with highly damped and highly oscillatory modes. Instead, the fast subsystem provides a very good approximation of the original model's response but with a DC gain offset. We propose a correction to rectify the DC gain offset and illustrate the findings using an islanded micro-grid electric power system model.

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