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DWELL-TIME AND DISTURBANCE MONITORING FOR PEAKING AVOIDANCE AND PERFORMANCE IMPROVEMENT IN HIGH-GAIN OBSERVER BASED SLIDING MODE CONTROL†

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Abstract. This paper addresses the design of sliding mode tracking control based on high-gain observers for a class of uncertain strongly nonlinear systems. Peaking avoidance by means of a new control activation dwell-time strategy is shown to enhance the stability and performance of the controller. Advantages compared to a well known peaking avoidance technique, which consists in globally bounding the control signal through saturation, are discussed. One advantage is that global (practical) stability is made possible for open loop unstable plants. Semi-global stability are achievable with both strategies but it turns out that larger regions of attraction and significantly improved transient behavior or performance recovery can be obtained with significantly smaller observer gains using the dwell-time strategy. Furthermore, a new monitoring scheme is also proposed to deal with the deleterious effect of peaking induced by non-smooth *output disturbances*.

Keywords. Uncertain nonlinear systems, sliding mode control, output-feedback, high-gain observers, peaking avoidance.

1 Introduction

High gain observers (HGOs) play a fundamental role in the modern theory of nonlinear control systems. One of the pioneering works that implicitly used such observers was presented by Emelyanov and co-workers [1] in the context of output-feedback sliding mode stabilization. It was however Khalil [2] who formulated the observer as a high gain observer having in mind its wide potential applications for output-feedback control of general nonlinear systems.