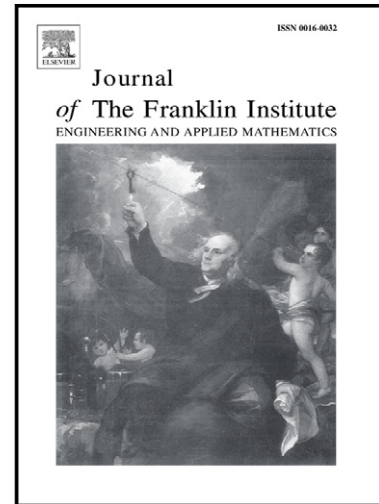


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Discrete Time Second Order Sliding Mode Observer for Uncertain Linear Multi Output System

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Abstract

This paper presents a second order sliding mode observer (SOSMO) design for discrete time uncertain linear multi-output system. The design procedure is effective for both matched and unmatched bounded uncertainties and/or disturbances. A second order sliding function and corresponding sliding manifold for discrete time system are defined similar on the lines of continuous time counterpart. A boundary layer concept is employed to avoid switching across the defined sliding manifold and the sliding trajectory is confined to a boundary layer once it converges to it. The condition for existence of convergent Quasi Sliding Mode (QSM) is derived. The observer estimation errors satisfying given stability conditions converge to an ultimate finite bound (within the specified boundary layer) with thickness $O(T^2)$ where T is the sampling period. A relation between sliding mode gain and boundary layer is established for the existence of second order discrete sliding motion. The design strategy is very simple to apply and is demonstrated for three examples with different class of disturbances (matched and unmatched) to show the effectiveness of the design. Simulation results to show the robustness with respect to the measurement noise are given for SOSMO and the performance is compared with Pseudo Linear Kalman filter (PLKF).

Keywords: Second order sliding mode, Quasi sliding mode, Boundary layer, Matched and unmatched disturbances

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