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Setting Uncertainty Conditions Using Singular Values for Repetitive Control in State Feedback

Authors : Muhammad A. Alsubaie, Mubarak K. H. Alhajri, Tarek S. Altowaim

Abstract : A repetitive controller designed to accommodate periodic disturbances via state feedback is discussed. Periodic disturbances can be represented by a time delay model in a positive feedback loop acting on system output. A direct use of the small gain theorem solves the periodic disturbances problem via 1) isolating the delay model, 2) finding the overall system representation around the delay model and 3) designing a feedback controller that assures overall system stability and tracking error convergence. This paper addresses uncertainty conditions for the repetitive controller designed in state feedback in either past error feedforward or current error feedback using singular values. The uncertainty investigation is based on the overall system found and the stability condition associated with it; depending on the scheme used, to set an upper/lower limit weighting parameter. This creates a region that should not be exceeded in selecting the weighting parameter which in turns assures performance improvement against system uncertainty. Repetitive control problem can be described in lifted form. This allows the usage of singular values principle in setting the range for the weighting parameter selection. The Simulation results obtained show a tracking error convergence against dynamic system perturbation if the weighting parameter chosen is within the range obtained. Simulation results also show the advantage of weighting parameter usage compared to the case where it is omitted.

Keywords : model mismatch, repetitive control, singular values, state feedback
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