Fixed-Structure Sampled-Data Feedforward Control for Multivariable Motion Systems

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Abstract: Increasing performance requirements in high-precision mechatronic systems lead to a situation where both multivariable and sampled-data implementation aspects need to be addressed. The aim of this paper is to develop a design framework for a multi-input multi-output feedforward controller to improve continuous-time tracking performance through learning. The sampled-data feedforward controller is designed with physically interpretable tuning parameters using a multirate zero-order-hold differentiator. The developed approach enables interaction compensation for multi-input multi-output systems and the feedforward controller parameters are updated through learning. The performance improvement is experimentally validated in a multi-input multi-output motion system compared to the conventional feedforward controllers.

Keywords: feedforward control, reference tracking, multi-input multi-output system, sampled-data control, multirate inversion, iterative learning control