

Improving Intersample Performance with Linearly Parameterized Feedforward using Sampled-Data Differentiator

Masahiro Mae* Max van Haren** Wataru Ohnishi*
Tom Oomen**,** Hiroshi Fujimoto*

* *Department of Electrical Engineering and Information Systems,
Graduate School of Engineering, The University of Tokyo, Japan.
(e-mail: mmae@ieee.org)*

** *Department of Mechanical Engineering,
Eindhoven University of Technology, The Netherlands.*

*** *Delft Center for Systems and Control,
Delft University of Technology, The Netherlands.*

Abstract: Increasing performance requirements result in demanding intersample performance improvement in industrial motion systems while there is a limitation of sampling time. The aim of this study is to improve intersample performance by using a discrete-time linearly parameterized feedforward while maintaining on-sample performance in high-precision mechatronic systems. The developed approach is parameterized with a sampled-data differentiator using single-rate and multirate inversion. The resulting framework improves both on-sample and intersample behavior compared to using a conventional backward differentiator. The performance improvement is demonstrated in a benchmark motion system.

Keywords: feedforward, discrete-time system, sampled-data control, zero-order-hold, multirate
