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Stability and robustness analysis of cyclic pseudo-downsampled iterative learning control.
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Summary: Cyclic pseudo-downsampled Iterative Learning Control (ILC) has shown advantages to achieve good learning performance for trajectories containing high-frequency components and has been verified on industrial robot application. This scheme is a multirate ILC in nature and downsamples the fast rate signals (with a sampling period T) to slow rate signals (with a sampling period mT) with a ratio m. Then ILC is carried out on the downsampled signals and interpolates its output to a fast rate signal. For the next iteration, ILC scheme downsamples the signals with the same ratio m but at different sampling points with a time shift T. This process is repeated on the iteration axis so that ILC updates the input of all the sampling points once every m cycles. By experiments [*B. Zhang, D. Wang, Y. Ye, K. Zhou* and *Y. Wang*, 'Cyclic pseudo-downsampled iterative learning control for high performance tracking', Control Engineering Practice 17, 957–965 (2009)], this scheme has been shown effective and comparisons with other relevant schemes demonstrate its superior performance. In this article, this cyclic pseudo-downsampled ILC scheme is examined analytically and proved mathematically to be stable and robust. Extensions and insights are also established based on the theoretical developments and simulation verification. pseudo-downsampled ILC scheme.

MSC:

93D09 Robust stability
93C55 Discrete-time control/observation systems
68T05 Learning and adaptive systems in artificial intelligence
93C85 Automated systems (robots, etc.) in control theory

Keywords:

iterative learning control; cyclic pseudo-downsampling; stability; robustness

Full Text: DOI

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