

Compensating position-dependent disturbances in mechatronic systems: a new repetitive control framework with applications to a substrate carrier

Citation for published version (APA):

Mooren, N., Witvoet, G., & Oomen, T. A. E. (2020). *Compensating position-dependent disturbances in mechatronic systems: a new repetitive control framework with applications to a substrate carrier*. Paper presented at 1st Euspen Special Interest Group Meeting on Precision Motion Systems & Control, Aachen, North Rhine-Westphalia, Germany.

Document status and date:

Published: 17/11/2020

Document Version:

Publisher's PDF, also known as Version of Record (includes final page, issue and volume numbers)

Please check the document version of this publication:

- A submitted manuscript is the version of the article upon submission and before peer-review. There can be important differences between the submitted version and the official published version of record. People interested in the research are advised to contact the author for the final version of the publication, or visit the DOI to the publisher's website.
- The final author version and the galley proof are versions of the publication after peer review.
- The final published version features the final layout of the paper including the volume, issue and page numbers.

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Compensating position-dependent disturbances in mechatronic systems: a new repetitive control framework with applications to a substrate carrier

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Abstract

Mechatronic systems such as printers, wafer scanners and piezo steppers, are often subject to position-dependent disturbances such as cogging, commutation errors or imbalances. Take as an example the substrate carrier as show in Fig. 1, which is one of the pilots within I-MECH [1]. This system consists of a rotating steel belt, that is driven by two rollers. The rotating nature induces disturbances that are repeating in the roller position domain, see Fig. 1. At constant belt velocities, the disturbance is periodic in time and can be effectively attenuated by repetitive control (RC) [2]. However, for arbitrary velocity profiles, position-domain disturbances in general are not periodic, hence RC is ineffective, in fact may lead to severe performance deterioration.

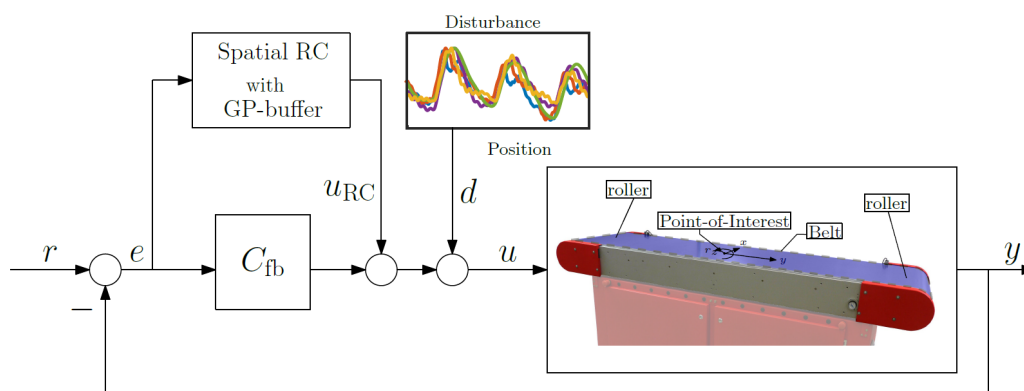


Figure 1: Spatial repetitive control framework for position-domain disturbances in the generic substrate carrier.

A new repetitive control approach with a Gaussian Process (GP) based buffer is presented, that effectively deals with position-domain disturbances. The key idea is to generate a disturbance model by means of a spatial buffer based on a GP, which enables direct incorporation of prior knowledge [3]. The method is successfully applied to the experimental setup.

Acknowledgements: The authors want to thank Tom van de Laar, Ibrahim Açan, Arend-Jan Beltman and Lennart Blanken for their contribution to this work. This research received funding from the European Union H2020 program under grant agreement 637095, and ECSEL-2016-1 under grant agreement 737453 (I-MECH)

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