

International Journal of Production Research >

Volume 53, 2015 - [Issue 15](#)

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Engineering model-based Bayesian monitoring of ramp-up phase of multistage manufacturing process

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Pages 4594-4613 | Received 18 Nov 2013, Accepted 28 Dec 2014, Published online: 29 Jan 2015

🗨️ Cite this article 🔗 <https://doi.org/10.1080/00207543.2015.1005247>



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Abstract

Process monitoring of full mass production phase of multistage manufacturing processes (MMPs) has been successfully implemented in many applications; however, monitoring of ramp-up phase of MMPs is often more difficult to conduct due to the limited information to establish valid process control parameters (such as mean and variance). This paper focuses on the estimation of the process control parameters used for monitoring scheme design of ramp-up phase of MMPs. An engineering model of variation propagation of an MMP is developed and reconstructed to a linear model, establishing a relationship between the error sources and the variation of product characteristics. Based on the developed linear model, a two-step Bayesian method is proposed to estimate the process control parameters. The performance of the proposed Bayesian method is validated with simulation data and real-world data, and the results

demonstrate that the proposed method can effectively estimate process parameters during ramp-up phase of MMP.

Keywords:

Bayesian method

multistage manufacturing process

engineering model

ramp-up phase

parameter estimation

Acknowledgements

The authors greatly acknowledge the editor and the referees for their valuable comments and suggestions that have led to a substantial improvement of the paper. This work was supported by the National Natural Science Foundation of China [grant number 51275558]; National Key Science and Technology Research Program of China [grant number 2014ZX04015-021]; Shanghai Rising-Star Program [grant number 13QA1402100].

Additional information

Funding

This work was supported by the National Natural Science Foundation of China [grant number 51275558]; National Key Science and Technology Research Program of China [grant number 2014ZX04015-021]; Shanghai Rising-Star Program [grant number 13QA1402100].



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