Reinforcement Learning Based Buffer Allocation Problem on Complex Production Line

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Abstract

We present a model and algorithm of Reinforcement Learning (RL) based Buffer Allocation Problem (BAP) for complex production lines. The BAP has been a critical part of the production line design and inventory policy construction. It determines the buffer size within the production line to achieve the highest production rate considering the uncertainty of the production line such as machine failures and repairs. The existing BAP models are designed to optimize buffers for highly simplified production lines. However, it is still a challenge to evaluate an optimization buffers for actual complex production lines with the existing approaches and algorithms. In this study, we present a model and algorithm to find the optimal buffer space for complex production lines using simulation based Reinforcement Learning (RL). Here, we build a complex production line model with a simulator and integrate the model with the RL based algorithm, seeking an optimal buffer allocation policy. The preliminary results show that the proposed model reliably fines an optimal buffer size for complex production lines.

Keywords
Buffer Allocation Problem, Complex Production Line, Reinforcement Learning, Simulation

Biographies

Vina Sari Yosephine received her B.S Degree in Mechanical Engineering from Bandung Institute of Technology in 2006 and M.S. Degree in Industrial and System Engineering from Korea Advanced Institute of Science and Technology (KAIST) in 2013. She is currently pursuing her Ph.D in Industrial and System Engineering at KAIST. Her research includes stochastic modeling, system optimizations, and Industrial Engineering education. She is also interested in educational technology and innovative teaching in Industrial Engineering and Operations Research. She is currently working on the distinct application of advanced production system engineering..

Young Jae Jang received his Ph.D. degree in mechanical engineering from Massachusetts Institute of Technology (MIT) in 2007 and a double M.S. degree in mechanical engineering and operations research from MIT in 2001. He received a B.S degree in aerospace engineering from Boston University in 1997. He is currently an Associate Professor in the Industrial and Systems Engineering Department at the Korea Advanced Institute of Science and Technology (KAIST), South Korea. His current research includes the stochastic modeling of complex systems, and optimizations in transportation and logistics systems. He has been involved in the KAIST On-Line Electric Vehicle (OLEV) project developing and commercializing the innovative wireless charging electric vehicle. The project was recognized as the 50 Best Innovations of 2010 by TIME Magazine. His role in the project is to develop the optimal energy management system to integrate the vehicle system to the road traffic network. He has been published numerous technical papers out of the OLEV technology. His recent work “The Optimal Economic Design of the Wireless Powered Transportation System” was selected as the Best Paper in the 2013 International Conference on Intelligent Manufacturing and Logistics Conference. He is also strongly interested in education innovation. He has founded a KAIST LEGO System (KLS) Laboratory in 2013 from the support from the Department of Industrial and Systems and Education Innovation Center at KAIST. Dr. Jang is the Technical Program Chair of the 2014 IEEE

Vehicular Technology Workshop on Emerging Technologies on Wireless Power and the Co-Chair of the International Symposium on Semiconductor Manufacturing Intelligence (ISMI) 2015. He also served as an Associate Guest Editor of the Special Issue of Wireless Charging Technology on IEEE Transactions on Power Electronics, 2015. Before he joined KAIST, he worked at Micron Technology, Inc., VA, USA, where as project manager, he led a global initiative to improve the efficiency of the manufacturing facilities located worldwide. While working at Micron, he was also involved in activities supporting the companys operational and strategic decision making using quantitative modeling and analysis techniques.