

International Conference on

Design and Production Engineering

July 25-26, 2016 Berlin, Germany

Cellular automaton modeling of CFRP component production for airframes

Tetsuya Morimoto¹, Yutaka Iwahori¹, Satoshi Kobayashi² and Yosuke Nagao³¹Japan Aerospace Exploration Agency, Japan²Tokyo Metropolitan University, Japan³Kanagawa Institute of Technology, Japan

An asymmetric simple exclusion process (ASEP) cellular automaton (CA) model—a ‘bucket brigade’ model—was implemented for production lines of carbon fiber reinforced plastic (CFRP) airframes. Aerospace CFRPs have limited shelf life to put minimal buffer periods for each step to approach a lean production in the way of time discrete ASEP CA model. ASEP CA model is known to reduce throughput drastically if 1) excessive density of inventories surpasses stagnation point and 2) steps are not harmonized, therefore, even by far improvement rate at a step can negate the whole inventories throughout the production line. Using the model, we conduct a case study for Boeing 787 production line in Japan and USA, and our results suggest that reduced inventory input could have enhanced the apparent delivery rate up to the target, 16 units delivery per month, drastically earlier than the reality. We then estimate future trend of production rate for an imaginary airframe to find that modulating production rate is difficult for CFRP component line as if it were the bucket brigade of the ‘Sorcerer’s Apprentice.’

Biography

Tetsuya Morimoto is an Associate Fellow at Aeronautical Technology Directorate at Japan Aerospace Exploration Agency (JAXA). He holds a Doctor of Engineering degree from the University of Tokyo.

morimoto.tetsuya@jaxa.jp

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