Engineering Applications of Computational Methods

Volume 8

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Yuchen Li

Assembly Line Balancing under Uncertain Task Time and Demand Volatility

Springer

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Foreword

I have always had an enthusiasm for innovation, and I am always willing to share many of them with students. So, when my former student Yuchen Li told me about his book project about assembly line balancing under uncertainties, which is a very novel subject in combinatorial optimization, I was intrigued.

I first made Yuchen's acquaintance in early 2009. He visited my office and discussed some potential opportunities for studying abroad. My first impression is that his goal is not merely for pursuing a degree but to establish a prospective career in academia. I introduced him to the framework of the research on reliability theory and career path. Since then, he joined my research group and got involved in a few major academic conferences. We wrote a paper together "Return on Investment of a LED Lighting System" and published it with IEEE. The paper is about to apply the prognostic health management to the LED lighting system and estimate the cost.

While he was grinding his research capability in combinatorial optimization as a Ph.D. candidate at Rutgers University in the USA, I also achieved a new reliability theory—belief reliability. The belief reliability combines probability theory and uncertainty theory to generate a chance measure of reliability. It is a model-based reliability metric that considers both what we know (expressed as reliability models) and what we do not know (expressed as epistemic uncertainty in the reliability models) about the reliability.

My favorite parts of the book are Chaps. 3 and 4. They are really up my alley since, to my best knowledge, it was the first time the uncertainty theory and belief reliability were applied in the assembly line balancing area. In Sect. 3, uncertainty theory is utilized to model the non-stationary task times which are key parameters in the two-sided assembly line balancing problem. In Sect. 4, the belief reliability is conceptualized in assembly line balancing; a multi-objective mathematical model, where the belief reliability and efficiency of the assembly line are the objectives, is developed. Some important propositions are derived, which can lay a solid foundation for future works in this subject matter.

Overall, the scope of the book is to present the authors' recent progress on the assembly line balancing problem under uncertainties. Further, the book can serve as a toolbox for the application of belief reliability theory in optimization problems because a plethora of models and algorithms are provided.

Dr. Li has written a must-read book for anyone considering assembly line balancing, belief reliability and their joint research. This book does a great job of creating a sense that even the smallest idea can make a big difference in expanding the research frontier and ends with a powerful call to action that intrigues the reader. Read this book and discuss it with the young phenom.

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Writing a book is harder than I thought and more rewarding than I could have ever imagined. None of this would have been possible without my family, Dad (Jin Li), Mom (Tao Ding), and daughter (Xinglai Li). They stood by me during every struggle and all my successes. That is true love.

I am eternally grateful to my editors, Mengchu Huang and Revathy Manikandan, who provided their editorial help, keen insight, and ongoing support in leveling up my book to perfection.

I am forever indebted to Dr. Liang Gao, who created the book series **Engineering Applications of Computational Methods** to which my book belongs. It is a great book series, which encapsulates new and developing computational methods using big data, machine learning, and AI. These state-of-the-art methods could be applied to engineering fields, such as manufacturing, industrial engineering, control engineering, civil engineering, energy engineering, and material engineering.

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