

## BOOK REVIEW

# Remanufacturing: Modeling and Analysis

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As the authors state in the preface of the book, “the collected EOL (end of life) products are transported to a remanufacturing plant where they are disassembled into parts. Following the cleaning and inspection of the disassembled parts, repair and replacement operations are performed to deal with defective and worn-out parts. Finally, all parts are reassembled into a remanufactured product, which is expected to function like a new product. In addition to repair and replacement, some parts or modules may also be upgraded while remanufacturing a product” (page *xix*).

Remanufacturing is not the only option to treat the EOL products by various industries in their attempts to observe the ever more strict regulations meant to ensure an environmentally friendly manufacturing to the largest extent possible and to gain higher economic efficiency. Besides remanufacturing, other possible options for recovering valuable parts or materials are repairing, reconditioning or recycling. The authors remark that remanufacturing, if possible, is the most promising and effective option not only with respect to environment related regulations, but also to expected financial gains. A variety of other benefits of remanufacturing can be envisaged, such as: energy and material savings, job opportunities for retired and laid-off factory workers, possible up-graded performance of the remanufactured products and so on, while a less monotonous and creative work is expected as well (page 5). According to the authors, “there are 70,000 remanufacturing companies in the United States creating \$53 billion per year income, and nearly half million people are employed by these firms (page 3).

In the context briefly described above, the authors propose a book meant to address the most significant issues of the domain which “can serve as foundations for researchers to build bodies of knowledge in these fast growing areas of remanufacturing systems” and

help the industry people to utilize the models proposed in solving the practical problems they encounter (page 389).

The book is the result of collaboration of two authors who are well known among the academic people for their publications in the domain of “green manufacturing”. Dr. Ilgin received his PhD degree in industrial engineering from the Northeastern University in Boston. His scientific interests include, among others, the environmentally conscious manufacturing, product manufacturing, reverse logistics, simulation and so on.

Dr. Gupta is with the Northeastern University in Boston where he is a professor of mechanical and industrial engineering and the director of the Laboratory for Responsible Manufacturing. His scientific interests include, among others, operational research, engineering economy, supply chain management and production planning and control. He is the author/coauthor of over 400 technical papers, journal articles and books. For his remarkable teaching and research activities he received several recognition tokens, such as the Industrial Engineering Professor Award and an outstanding research award from his university.

The majority of over 400 pages of the book describe models and techniques frequently presented in the industrial engineering texts adapted here to address and solve typical problems which can be encountered in remanufacturing activities, such as design, planning and processing. The book is organized accordingly in five parts as it follows:

*Part I*, entitled “Background” is composed of two chapters meant to set the stage for the examples and models to be presented in the subsequent chapters by describing the application domain and techniques envisaged to be utilized. The first chapter contains a general presentation of the characteristic features of the manufacturing systems. The second one

reviews the majority of the industrial engineering and operation research techniques which are used in the more than one of the subsequent chapters such as: Taguchi Loss functions, AHP (Analytical Hierarchy Process), TOPSIS (Technique for Order Preference by Similarity to Ideal Solution), goal programming, fuzzy logic, linear physical programming, house of quality, line balancing methods, simulation, experimental design and orthogonal arrays, MOST (Maynard Operations Sequence Technique), linear integer programming, non-linear programming, queuing theory and genetic algorithms.

*Part II*, entitled “Design Issues”, comprises four chapters to address relevant design aspects of the products, reverse and closed-loop supply chains, as well as the selection of used products and evaluation of remanufacturing facilities.

*Part III*, entitled, “Planning Issues”, is made up of 13 chapters. It starts by describing, in details, several techniques utilized in forecasting, job sequencing and inventory management. Then, other examples and techniques are presented concerning capacity planning, pricing methods,

control mechanisms (including adapted Kanaban and Multi-kanaban systems), uncertainty and product acquisition management, supplier evaluation, optimal supplier portfolio, selection of third-party reverse logistics providers and performance measurement.

*Part IV*, entitled “Processing Issues”, is made up of four chapters. Chapter 20 contains various heuristic models to be used in the disassembly processes. Cleaning, inspection and reassembly issues are addressed in chapters 21 through 23.

*Part V*, entitled “Epilogue”, contains the conclusions of the book which reiterate several ideas exposed in the preface and chapter 1.

This book is a very good introduction to the problems and reported results in the domain of remanufacturing industries. It can be a valuable text both for academic people and practitioners from industry. The book may be viewed as a new valuable component of a series of books one author (Prof. Gupta) has prepared together with his colleagues with a view to promoting the methods and techniques for sustainable manufacturing.

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