



Review

The evolution and future of manufacturing: A review

Behzad Esmailian^a, Sara Behdad^{b,*}, Ben Wang^c^a Industrial and Systems Engineering, Northern Illinois University, DeKalb, IL, United States^b Mechanical and Aerospace Engineering, Industrial and Systems Engineering, University at Buffalo, Buffalo, NY, United States^c Georgia Tech Manufacturing Institute, Stewart School of Industrial & Systems Engineering, Georgia Tech, Atlanta, GA, United States

ARTICLE INFO

Article history:

Received 20 July 2015

Received in revised form 2 January 2016

Accepted 7 March 2016

Available online 16 April 2016

Keywords:

Advanced manufacturing
Data analytics in manufacturing
Sustainable manufacturing
Design for manufacturing
Remanufacturing

ABSTRACT

Manufacturing is continuously evolving from concept development to methods and tools available for the production of goods for use or sale. Traditionally, manufacturing refers to an industrial production process through which raw materials are transformed into finished products to be sold in the market. However, these days manufacturing is considered to be an integrated concept at all levels from machines to production systems to an entire business level operation.

Although there have been considerable developments in manufacturing technologies and processes, the actual scope and elements of manufacturing systems are complex and not adequately defined. This paper provides a review of both the tangible and intangible elements of manufacturing systems and presents a state-of-the-art survey of published work. It studies the evolution of research in manufacturing starting from past and current trends to future developments. How manufacturing systems have been classified is also presented. Through this extensive survey of the literature, future directions of this changing field are suggested.

© 2016 The Society of Manufacturing Engineers. Published by Elsevier Ltd. All rights reserved.

Contents

1. Introduction.....	80
2. Technical and engineering aspects of production systems: Technology and equipment	81
2.1. Manufacturing processes.....	81
2.2. Industrial control systems	81
2.3. Industrial robotics	82
2.4. Fixtures and jigs in assembly systems	82
2.5. Material handling systems	82
2.6. Storage and warehouse management system	82
2.7. Section summary	83
3. Planning aspects: Operating rules and process planning	83
3.1. Production, inventory and resource planning	83
3.1.1. Demand uncertainty.....	83
3.1.2. Variability in manufacturing systems	83
3.2. Production scheduling and lot sizing	83
3.3. Quality control	84
3.4. Section summary	84
4. Taxonomy of manufacturing systems	84
5. Design for manufacturing	85
5.1. Section summary	86
6. Remanufacturing.....	86
6.1. Remanufacturing business models	87

* Corresponding author. Tel.: +1 7166455914; fax: +1 7166452883.

E-mail addresses: besmaeilian@niu.edu (B. Esmailian), sarabehd@buffalo.edu (S. Behdad), ben.wang@gatech.edu (B. Wang).

6.2.	Production, scheduling and inventory planning of remanufacturing systems	87
6.3.	Determination of recovery options	88
6.4.	Environmental and cost analyses of remanufacturing operations	88
6.5.	Remanufacturing and product design	88
6.6.	Session summary	88
7.	Environmentally conscious manufacturing and sustainable manufacturing	88
7.1.	Session summary	89
8.	New manufacturing paradigms originated form data analytics	90
8.1.	Smart manufacturing, smart supply chain, data analytics in manufacturing	90
8.1.1.	Data visualization	90
8.2.	Social manufacturing	90
8.3.	Cloud manufacturing	91
8.4.	Cloud-based remanufacturing	91
8.5.	Cyber-physical systems	92
8.6.	Session summary	93
9.	Advanced manufacturing	93
9.1.	Nano-manufacturing	93
9.2.	Semiconductor manufacturing	93
9.3.	Additive manufacturing	93
9.4.	Session summary	95
10.	Conclusions and future trends	95
	References	95

1. Introduction

As new concepts are introduced in manufacturing, the research community should be able to identify future research frontiers. To date, there has been relatively little review of advanced manufacturing concepts in the research literature. However, new trends in advanced manufacturing are emerging and serve as the motivation behind this research.

Table 1 provides a list of previous review papers in this field. As shown, the scope of previous reviews is limited to a specific topic within a particular manufacturing area. This paper presents a holistic view of manufacturing by analyzing a broad range of publications covering myriad subareas and topics. Some of the drivers that are causing industry to adopt new initiatives in their enterprises, processes, production systems, and equipment levels are also noted.

A review of the literature surveyed reveals that manufacturing systems are classified differently according to their development. It is a challenge to ascertain a consistent type or category of a manufacturing system from the literature. In fact, a more appropriate view is that a number of taxonomies are needed to investigate different aspects of manufacturing.

We organize the literature into eight main areas (1) technical and engineering aspects of production systems, including technology and equipment (2) planning aspects, including operating rules and process planning, (3) taxonomies of manufacturing systems, (4) designs for manufacturing, (5) remanufacturing, (6) sustainable manufacturing, (7) new manufacturing paradigms, and (8) advanced manufacturing concepts. These areas are explained in Sections 2–9, respectively. At the end of each section, we provide our thoughts, prediction and recommendations for further research. In some subsections, several qualitative and quantitative metrics have been applied to assess technology maturation, research saturation, and under-developed areas. Fig. 1 provides more details on the overall structure of the paper.

We have used a three-stage qualitative research method (identification, classification and evaluation) similar to a recent review by Zaman [41] to analyze prior studies. The relevant studies were identified through Engineering Village, Compendex, Inspec & GEOBASE databases and limited by articles published in 1999 to April 2015. Finally, studies were classified and evaluated based on the structure shown in Fig. 1.

Table 1

Previous review papers and their scope.

Study	Scope
[1]	Cloud mfg.
[2]	Cellular mfg.
[3]	Just-in-time mfg. systems
[4]	Energy efficiency of mfg. processes
[5]	Disassembly sequence generation
[6]	Design for remanufacture
[7]	Mass customization
[8]	Assembly process planning
[9]	Additive mfg.
[10]	Information technology in mfg.
[11]	Simulation in mfg. systems
[12]	Additive mfg. and its social impacts
[13]	Lean mfg.
[14]	Agile mfg. systems
[15]	Data mining in mfg.
[16]	Cost engineering for manufacturing
[17]	Hybrid mfg. processes
[18]	Scheduling in cellular mfg. systems
[19]	Flexibility in mfg. systems
[20]	Web-based mfg. systems
[21]	Green supply chain
[22]	Intelligent mfg.
[23]	Sustainable lifecycle design
[24]	Mfg. facility location and sustainability
[25]	Sustainable mfg.
[26]	Environmentally conscious mfg.
[27]	Environmentally conscious design
[28]	Environmentally conscious design and mfg.
[29]	Remanufacturing
[30]	Green logistics
[31]	Design for remanufacturing
[32]	Sustainable supply chain
[33]	Facility location
[34]	Green supply chain
[35]	Sustainable supply chain
[36]	Quantitative models for reverse logistics
[37]	Sensors for unmanned machining
[38]	Performance measure in mfg. systems
[39]	Control architecture in automated mfg.
[40]	Servitization of mfg. systems

As new manufacturing paradigms coming to the market, the existing building blocks of manufacturing systems should be studied carefully to explore how new technologies influence the current infrastructure. Therefore, Sections 2 and 3 of this paper are

Download English Version:

<https://daneshyari.com/en/article/1697368>

Download Persian Version:

<https://daneshyari.com/article/1697368>

[Daneshyari.com](https://daneshyari.com)