Coordination and Optimization of Large Equipment Complete Service in Cloud Based Manufacturing

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ABSTRACT

The paper studies the cloud manufacturing service platform and mode in the coordination and optimization of large equipment complete service (LECS). A set of theory based system of coordination and optimization is systematically established to support and implement LECS’ cloud manufacturing mode. The research results show that the collaborative logic framework proposed is of macro guidance significance; the composite synergy mechanism system designed realizes all-round cooperative target; the collaborative optimization model and algorithm established have validity and practicality through instance verification. It systematically realizes the collaborative management of resource choice and optimizing configuration, the plan and control in the process of service, and so on. It can ensure the stability of manufacturing resource service seamless, green, environmental protection, and high quality. It achieves optimization of the overall system coordination. The study also provides a theoretical basis and scientific method for large equipment enterprise from manufacturer to a service integrator transformation.

KEYWORDS
Cloud Manufacturing Service Platform, Coordination and Optimization, Dynamic Interaction, Hamilton Principle, Large Equipment Complete Service, M Method

INTRODUCTION

Product platform is a key theory in mass customization method, and it can satisfy diversely customer needs at high efficiency service and reduce enterprise product development costs. Enterprises have set up product platforms that only use internal resources to develop products. Single product platform can’t deal with more complex customer demands because globalization market from relative stability changing into dynamic changeable and product diversity intensified and appear the demand of integrating internal and external resources manufacturing resources (Mell, 2009). So, it has to establish an open product platform system to support product platform collaborative development between and get resources transparently, realize the loose coupling cooperation between enterprises and task orientation resources dynamic reconfiguration (Foster, 2008; Silva, 2011).

Developed countries of the west have entered the era of service economy. The era of service economy accelerates socialized division of labour. Mutual service between enterprises is an important

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way to win the marketplace and strengthen the core competitive ability. At present, our country is in the middle and later stages of industrialization, with fully developed in manufacturing industry (Liu, 2011).

We face the problem of shifting from a manufacturing economy to a service economy which developed countries of the west faced in the ‘80s. In order to solve this outstanding issue (Pandey, 2010), we put forward guidelines as “Drive the industrialization with the information-based industry, promote the information-based industry with the industrialization” at national level and “Manufacturing Information Engineering” at implementation level. The current manufacturing informatization has made certain achievements in the research and application of solving manufacturing problems in the field of digital, integrated, collaborative and networked. But to the further application and achieve remarkable economic benefits, there are some difficult to overcome in the aspect of operation mode and technology, especially in business model, resource sharing and security. However, in recent years, the development and commercial application of the new generation of information technology, for example cloud computing, Internet of Things and Big Data, provides reference business model and new technical support for the transformation and upgrading of manufacturing industry.

In order to integrate and enhance the manufacturing industry, in April 2013, Germany launched industry 4.0 strategy based on the Internet of things and cyber-physical systems, aiming at the integration of information and communication technology, network technology and entity manufacturing technology, realizing the smart transformation of manufacturing industry. The United States in 2012 issued “advanced manufacturing national strategic plan”, combining with information technology and advanced manufacturing technology, building intelligent manufacturing technology platform, to revive the U.S. manufacturing. In view of the severe situation of domestic industrial structure imbalance, rising manufacturing costs, the weakness of traditional manufacturing competitive advantage, in 2015, the Chinese government launched the “China manufacturing 2025”, combining the entity manufacturing industry with the virtual network technology, to promote the transformation of industrial structure to the high-end. Cloud manufacturing is a new manufacturing mode to realize the integration of manufacturing industry and virtual network technology. It provides a direction for the integration of distributed manufacturing resources to solve the current manufacturing “information islands” and other problems. Machining with high processing precision, high production efficiency, quality and stability and other characteristics, is more suitable for highly customized multi-variety small and medium batch production. The study analyzes the main problems existing in China’s machining industry, summing up the requirements of the cloud manufacturing service composition platform in the machining industry. Based on process calculus, the architecture, design and implementation technologies of cloud manufacturing service composition modeling and verification platform are proposed. Cloud manufacturing service composition system prototype is developed, and its application case is given.

In this context, a new service-oriented networked manufacturing mode called cloud manufacturing (CM) is proposed in 2010. Its core is the “manufacturing” as the “service”. The propose of CM has been highly concerned by domestic and foreign research scholars, in the past four years, around the concept of CM, content, features, core technology, integrated technology, application mode and other direction, many scholars have carried out much meaningful research work. However, by combining the research status of CM, I think that the current CM research need to be resolve some key technologies as CM operation mode for specific application, especially the CM service model for the machining areas, the manufacturing resources cloud in machining, manufacturing service discovery method of machining, processing service optimization and system development strategy in CM environment.

The flourishing manufacturing industry is beneficial to the country’s thriving, from the point of the current development trend of global economic integration; the world is in a new revolution.
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