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ORIGINAL ARTICLE

A hybrid artificial bee colony algorithm for optimal selection of QoS-based cloud manufacturing service composition

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Abstract With the advent of cloud manufacturing (CMfg), more and more services in CMfg platforms may provide the same functionality but differ in performance. In order to insure the manufacturing cloud to match the complicated task requirements, composited CMfg service optimal selection (CCSOS) is becoming increasingly important. This study proposes a new approach for such CCSOS problems, the so-called hybrid artificial bee colony (HABC) algorithm, which employs both the probabilistic model of Archimedean copula estimation of distribution algorithm (ACEDA) and the chaos operators of global best-guided artificial bee colony to generate the offspring individuals with consideration of quality of service (QoS) and CMfg environment. Different-scale CCSOS problems are adopted to evaluate the performance of the proposed HABC. Experimental results have shown that the HABC can find better solutions compared with such algorithms as genetic algorithm, particle swarm optimization, and basic artificial bee colony algorithm.

Keywords Cloud manufacturing (CMfg) · Service composition · Optimal selection · Quality of service (QoS) · Hybrid artificial bee colony (HABC) algorithm

1 Introduction

Nowadays, information technologies (ITs) are crucial to the advance of manufacturing industry. Networked technology connects customers, partners, and public to work together; shares resources throughout the manufacturing supply chain; and improves the product efficiency. To fulfill the target of higher performance, lower operating cost, and faster time-to-market for new products, many networked or service-oriented manufacturing paradigms, for example, virtual enterprise, application service provider, crowd souring, industrial product service system, manufacturing grid, and so on, have been put forward and used widely [1–3]. However, they put much emphasis on distributed partner connection by networks with less consideration of cooperative management and generalized dynamic sharing of distributed resources. Meanwhile, cloud computing [4] as a new application mode for enabling ubiquitous, convenient, on-demand network access to configurable computing resources is springing up. It combines computing power and storage resources as a shared "cloud" by virtualization technology and provides them to users on demand with minimal management effort or service provider interaction.

Inspired by cloud computing, cloud manufacturing (CMfg) was proposed to share and provide on-demand networked manufacturing services for users to satisfy specific manufacturing task needs [5]. In CMfg, various manufacturing resources are sensed and interconnected by the Internet of Things (IoT), and cloud computing, virtualization, and service-oriented technologies are adopted to encapsulate them as cloud-based services, which then form a huge "manufacturing cloud" under the intelligent control and management of CMfg platforms. The CMfg platform can intelligently analyze users' requests and search suitable, available manufacturing resources to meet their demands. Traditionally, networked manufacturing is inefficient and lack of flexibility, which provides services to users through resources of fixed number or solutions, whose business process is relatively fixed. For example, in agile manufacturing, the relationship between the core enterprise and its partners in the supply chain is long-term cooperation, not temporary working relationship. Unlike the previous manufacturing modes, CMfg expands the service

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