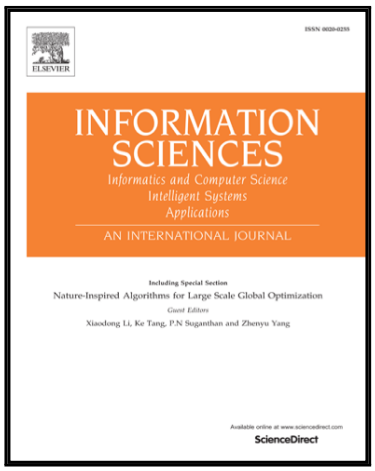

An adaptive multi-population differential artificial bee colony algorithm for many-objective service composition in cloud manufacturing

Jiajun Zhou , Xifan Yao , Yingzi Lin , Felix T.S. CHAN , Yun Li

PII: S0020-0255(18)30364-5
DOI: 10.1016/j.ins.2018.05.009
Reference: INS 13637

To appear in: *Information Sciences*

Received date: 12 January 2018
Revised date: 26 April 2018
Accepted date: 2 May 2018

Please cite this article as: Jiajun Zhou , Xifan Yao , Yingzi Lin , Felix T.S. CHAN , Yun Li , An adaptive multi-population differential artificial bee colony algorithm for many-objective service composition in cloud manufacturing, *Information Sciences* (2018), doi: 10.1016/j.ins.2018.05.009

An adaptive multi-population differential artificial bee colony algorithm for many-objective service composition in cloud manufacturing

Jiajun Zhou[1], Xifan Yao[1]*, Yingzi Lin[2], Felix T. S. CHAN[3], Yun Li[4]

1. School of Mechanical and Automotive Engineering, South China University of Technology, Guangzhou 510640, Guangdong, China

2. Intelligent Human Machine Systems Lab, Department of Mechanical and Industrial Engineering, Northeastern University, Boston, MA 02115, USA

3. Department of Industrial and Systems Engineering, The Hong Kong Polytechnic University, Hung Hom, Hong Kong

4. Faculty of Engineering, University of Strathclyde, Glasgow G1 1XQ, UK

Corresponding author, E-mail address:* mexfyao@scut.edu.cn

Abstract Several conflicting criteria must be optimized simultaneously during the service composition and optimal selection (SCOS) in cloud manufacturing, among which tradeoff optimization regarding the quality of the composite services is a key issue in successful implementation of manufacturing tasks. This study improves the artificial bee colony (ABC) algorithm by introducing a synergetic mechanism for food source perturbation, a new diversity maintenance strategy, and a novel computing resources allocation scheme to handle complicated many-objective SCOS problems. Specifically, differential evolution (DE) operators with distinct search behaviors are integrated into the ABC updating equation to enhance the level of information exchange between the foraging bees, and the control parameters for reproduction operators are adapted independently. Meanwhile, a scalarization based approach with active diversity promotion is used to enhance the selection pressure. In this proposal, multiple size adjustable subpopulations evolve with distinct reproduction operators according to the utility of the generating offspring so that more computational resources will be allocated to the better performing reproduction operators. Experiments for addressing benchmark test instances and SCOS problems indicate that the proposed algorithm has a competitive performance and scalability behavior compared with contesting algorithms.

Keywords Cloud manufacturing; Many-objective optimization; Evolutionary algorithm; Service composition;

1. Introduction

Cloud manufacturing (CMfg) refers to a service-oriented networked manufacturing model in which service consumers are enabled to configure, select, and utilize resources on demand so as to complete customized manufacturing tasks [9]. Adapted from the cloud computing model and Internet of things (IoT) into the field of manufacturing, CMfg was first coined by Li *et al* .[17] and is gaining significant attention from both academia and industry. CMfg aims at connecting consumers with small and medium-sized enterprises or individual engineers to form temporary, reconfigurable production lines, providing consumers with capable and qualified design and manufacturing services in a virtual community.

To facilitate the access and utilization of resources in heterogeneous environments, manufacturing resources or capacities in CMfg are virtualized and delivered in the form of services. However, due to the functional limitation of a single service, the complexity of a manufacturing task calls for a composite service in which multiple isolated resources are