ADAPTIVE, RESPONSIVE AND RECONFIGURABLE PRODUCT SUPPORT FOR FUTURE MANUFACTURING

Rossitza Setchi and Nikolaos Lagos

School of Engineering
Cardiff University
Cardiff, CF243AA, UK
{setchi; lagosn}@cf.ac.uk

Abstract. *The challenge for future manufacturing will be not only how to design new families of customized products and capacities for producing them, but also how to provide product support that is both highly customized and highly responsive. The aim of this paper is to address this challenge and facilitate the move towards reconfigurable manufacturing by providing manufacturing industry and research with an integrated approach to developing highly customized and responsive product support for the next generation of complex and highly customized products. The paper presents the key features of the proposed approach, its enabling technologies, architecture and development phases. These include development of training materials and their integration with the automation system, integration of the training materials with the diagnostic modules, and provision of context-aware training. The approach is illustrated with examples from the automotive industry.*

Keywords: Product support, Reconfigurable manufacturing, Training, Context, Customization, Adaptivity, Responsiveness, Reconfigurability, Ontology, Knowledge engineering, Semantics

1. **Introduction.** Global economic competition, rapid social and technological changes have forced manufacturing to face a new economic objective: manufacturing responsiveness, i.e. the ability of a production system to respond to disturbances which impact upon production goals [1], and consequently, its ability to adapt to changing market conditions. In the early 1990s the idea of agile production systems was pursued, enabling short changeover times between manufacturing different products. Since the end of the 1990s the trend is towards reconfigurable manufacturing systems (RMS), i.e. systems that are capable of being quickly adapted to changing market requirements by providing the needed functionality and capacity at any time [2].

Two recent foresight documents have recognized reconfigurable manufacturing as a priority area in manufacturing research. The Delphi study, Visionary Manufacturing Challenges for 2020, conducted by the USA's National Research Council has identified reconfigurable manufacturing as first priority among six grand challenges for the future of manufacturing [3]. The second study, The Future of Manufacturing in Europe 2015-2020, sponsored by the European Commission examined what technological knowledge and organizational capabilities are required by European manufacturing if it was to remain both competitive and sustainable by the year 2020 [4]. The study outlines customization, flexibility and responsiveness as key success factors and identifies reconfigurable manufacturing as a key enabling technology for the future of European manufacturing.

The globalization of manufacturing poses several problems including skill shortages and lack of adequate training in some instances as training materials rapidly become out