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STEP-NC BASED INTELLIGENT COMPUTING AND MACHINING

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Abstract. *The CNC industry is experiencing a revolutionary change in its fundamental data model and the way to drive the machine tools due to a newly published data model. This data model is called STEP-NC which has been made as an international standard. The purpose of this research is to investigate an intelligent STEP-NC controller, which involves deployment of the STEP-NC data model. The system contains five modules, STEP-NC Parser, Workingstep Optimiser, Knowledge Base, Machining Parameter Optimiser, and Tool-path Generator. The STEP-NC Parser is programmed in VC++; all STEP-NC entities can be extracted by the Parser. The Workingstep Optimiser is responsible for generating a list of Workingsteps with an optimal sequence. This is done through a genetic algorithm. The Knowledge Base provides the necessary information optimization. The Machining Parameter Optimiser uses artificial neural network techniques to calculate a set of optimal machining conditions. Finally, the Tool-path Generator advises an optimal tool-path based on an object-oriented algorithm.*
Keywords: CNC, Intelligence, STEP-NC, Tool path, Genetic algorithm, Artificial neural network.

1. **Introduction.** Today's computer numerical controlled (CNC) machines are well developed with varying capabilities such as error compensation, multi-axis control and multi-process manufacture (e.g. combining mill, turn, grind and even laser machining). In the mean time, these capabilities have made the programming task increasingly more difficult and machine tools themselves less adaptable [1]. Some efforts have been made to alleviate this problem, in particularly the trend towards open architecture control, based on OSACA [2] and OMAC (Open Modular Architecture Controller) [3], where third party software can be used at the controller working within a standard Windows® operating system. Although these developments have improved software tools and the architecture of CNC systems, vendors and users are still seeking a common language for CAD, CAPP, CAM, and CNC, which can integrate and translate the data and knowledge of each stage with no information loss. Though there are many CAM tools to support NC manufacture, the problem of adaptability and interoperability from system to system was and is still seen as one of the key issues in limiting the wider use of these tools.

The main reason for lack of adaptability and interoperability is that a G-code based part program only contains low-level information, which can be described as "how-to-do"