A Meta Level Formal Manufacturing Ontology for Meta Level Production Methods

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In a manufacturing environment, engineers and scientist often need to access and reason about general types of manufacturing methods without complex specifications and numbers. They may also want to disseminate the general process plans without sensitive details. This general knowledge is typically contained in the structure of knowledge bases which is composed of classes and can be referred to as Meta Level Knowledge. Typical manufacturing knowledge bases are designed for populated knowledge only and do not support capturing and reasoning over Meta level knowledge. Modelling to capture Meta level knowledge has been investigated in broader software community but the same is not true in manufacturing domain particularly in process planning. Moreover, an exploration to capture and reason about such knowledge in formal manufacturing ontologies has not been conducted. In this paper, a new formal ontology is proposed to capture meta level production methods. The ontology makes use of “powertypes” and “clabjects” to treat classes as objects. Meta level production methods can be captured using the proposed ontology. Manufacturability of features within a part family can be found at the meta level. Various tests are conducted to examine the ability to access, infer and reason about the meta level production methods to show the effectiveness of proposed ontological model.