A 5-axis pocket roughing strategy reducing the remaining material volume

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Auteurs : Baptiste Jousselin, Yann Quinsat, Christophe Tournier

In today's business environment, the trend towards more product variety and customization is unbroken. Due to this development, the need of agile and reconfigurable production systems emerged to cope with various products and product families. To design and optimize production systems as well as to choose the optimal product matches, product analysis methods are needed. Indeed, most of the known methods aim to analyze a product or one product family on the physical level. Different product families, however, may differ largely in terms of the number and nature of components. This fact impedes an efficient comparison and choice of appropriate product family combinations for the production system. A new methodology is proposed to analyze existing products in view of their functional and physical architecture. The aim is to cluster these products in new assembly oriented product families for the optimization of existing assembly lines and the creation of future reconfigurable assembly systems. Based on Datum Flow Chain, the physical structure of the products is analyzed. Functional subassemblies are identified, and a functional analysis is performed. Moreover, a hybrid functional and physical architecture graph (HyFPAG) is the output which depicts the similarity between product families by providing design support to both, production system planners and product designers. An illustrative example of a nail-clipper is used to explain the proposed methodology. An industrial case study on two product families of steering columns of thyssenkrupp Presta France is then carried out to give a first industrial evaluation of the proposed approach.