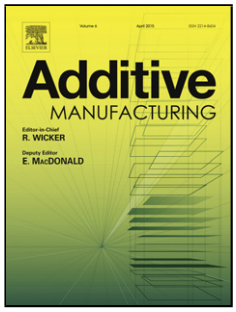

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The development of a strategy for direct part reuse using additive and subtractive manufacturing technologies

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Abstract

In recent years, combining additive and subtractive manufacturing technologies has attracted much attention from both industrial and academic sectors. Due to consolidated benefits of individual techniques, this combination provides new possibilities to manufacture products, and develop new strategies for recovering products at their end-of-life stage. This paper aims to develop a direct material reuse strategy based on such technique combination. The principle of the strategy is to manufacture new parts (or final parts) directly from end-of-life parts (or existing parts) without involving the material recycling phase. In this paper, a systematic methodology is proposed to develop the strategy. Firstly, the good mechanical characteristics of parts obtained by the strategy are confirmed. Thereafter, the design of process planning for combining additive and subtractive manufacturing processes is focused. This allows achieving the geometry and quality of final part from the existing part. The methodology for process planning design is developed in two major steps using the manufacturing feature concept, the knowledge of manufacturing processes, technological requirements, and available resources. In the first step, manufacturing features (i.e. machining and additive manufacturing features) are extracted from the information of the existing and final parts. In the second step, the process planning is generated from extracted features by respecting the relationships of features and the manufacturing precedence constraints. Finally, a case study is used to illustrate the proposed methodology.

Keywords: Additive manufacturing; Process planning; Feature; Remanufacturing; Life cycle.