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AN ANALYTIC FRAMEWORK FOR OPTIMAL MILLING PARAMETER SELECTION*

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ABSTRACT

The selection of optimal parameters is an important step in machining process definition. This paper presents a decision analytic framework for completing this task. The approach is demonstrated for titanium milling. An influence diagram showing the decision situation, the corresponding uncertainties, and the value is presented. The optimization objective is the selection of machining parameters that minimize cost while considering uncertainty in tool life and stability. The uncertainties are characterized using a probability distribution taking into account all available information. The cost associated with tool failure and unstable cutting conditions is incorporated in the cost formulation. A process probability tree showing the uncertainties and the corresponding costs is constructed. The optimization results show a 90% reduction in machining cost as compared to tool manufacturer-recommended parameters. The proposed framework is normative and robust and can be applied for optimizing process parameters in conventional (such as milling and turning) and non-conventional (such as electric discharge machining, electro-chemical machining) processes. A discussion section regarding inference, experimental design, and risk aversion is included.

Keywords: optimization, uncertainty, decision analysis, milling, stability, tool life

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