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A Flute Tracking System for Monitoring the Wear of Cutting Tools in Milling Operations

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Abstract : Monitoring of tool wear in milling operations is essential for achieving the desired dimensional accuracy and surface finish of a machined workpiece. Although there are numerous statistical models and artificial intelligence techniques available for monitoring the wear of cutting tools, these techniques cannot pin point which cutting edge of the tool, or which insert in the case of indexable tooling, is worn or broken. Currently, the task of monitoring the wear on the tool cutting edges is carried out by the operator who performs a manual inspection, causing undesirable stoppages of machine tools and consequently resulting in costs incurred from lost productivity. The present study is concerned with the development of a flute tracking system to segment signals related to each physical flute of a cutter with three flutes used in an end milling operation. The purpose of the system is to monitor the cutting condition for individual flutes separately in order to determine their progressive wear rates and to predict imminent tool failure. The results of this study clearly show that signals associated with each flute can be effectively segmented using the proposed flute tracking system. Furthermore, the results illustrate that by segmenting the sensor signal by flutes it is possible to investigate the wear in each physical cutting edge of the cutting tool. These findings are significant in that they facilitate the online condition monitoring of a cutting tool for each specific flute without the need for operators/engineers to perform manual inspections of the tool.

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