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AN INVESTIGATIVE STUDY OF THE INTERFACE HEAT TRANSFER COEFFICIENT FOR FE MODELLING OF HIGH SPEED MACHINING

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Abstract:
This paper is concerned with the development of an experimental setup and Finite Element (FE) modelling of dry sliding of metals to estimate interface heat transfer coefficient. Heat transfer between the chip, the tool, and the environment during the metal machining process has an impact on temperatures, wear mechanisms and hence on tool-life and on the accuracy of the machined component. For modelling of the metal machining process, the interface heat transfer coefficient is an important input parameter to quantify the transfer of heat between the chip and the tool and to accurately predict the temperature distribution within the cutting tool. In previous studies involving FE analysis of metal machining process, the heat transfer coefficient has been assumed to be between 10-500 kW/m^2 ^{o}C (0.49-24.5 BTU/sec/ft^2/^{o}F), with a background from metal forming processes (especially forging). Based on the operating characteristics, metal forming and machining processes are different in nature. Hence there was a need to develop a procedure close to metal machining process, to estimate this parameter in order to increase the reliability of FE models. To this end, an experimental setup was developed, in which an uncoated cemented carbide pin was rubbed against a steel workpiece while the later was rotated at speeds similar to the cutting tests. This modified pin-on-disc set-up was equipped with temperature and force monitoring equipment. A FE model was constructed for heat generation and frictional contact. The experimental and modelling results of the dry sliding process yield the interface heat transfer coefficient for a range of rubbing speeds.

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