Towards Inverse Simulation: Effect of Material Parameters on Machining Predictions

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Abstract. Machining is a quite relevant process on industry. However, despite its industrial importance, many parameters of the process are still chosen through empirical testing which is traduced in high time-consuming and costs. Based on that, an alternative approach to empirical methods is needed. Any other approach (numerical, analytical) needs a previous material characterization, which clearly influences on the accuracy of the predictions. This paper studies the effect that material characterization has on fundamental variables predictions, such as cutting forces or temperatures. A comprehensive analytical study has been carried out, based on Oxley theory and Johnson-Cook material law. Also the contact was considered, qualitatively, based on Coulomb friction law. The results were compared with experimental values and cutting simulations. The final aim of the paper is to present an optimized flow stress law, in terms of cutting forces and temperatures, for a commonly used aeronautical titanium alloy, Ti-6Al-4V. The temperatures were measured with infrared techniques to carry out the validations.

Keywords: Inverse simulation, machining modeling, material characterization, flow stress law, Ti-6Al-4V.