Milling force prediction by means of analytical model and 3D FEM simulations

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Abstract

In order to estimate the final surface quality in virtual simulation of cutting machine system, a great attention has to be focused both into the machine dynamic response and cutting force predictions. In particular, this paper refers to the prediction of cutting force behavior in milling machining operations. In literature two different approaches are generally used: analytical models and FEM simulations. Each approach covers different aspects of the global process: while analytical model allows to estimate, in quite short computational time, the three components cutting force distribution and theoretical roughness of the worked surface, the FEM simulations make possible to introduce other aspects such as the thermal effect, the 3D complex shape of the work piece or the tool wear influence.
An analytical model, based on Altinitas research activity, has been implemented into the Matlab code and the results, obtained by simulating different process parameters and tool shapes, have been compared to known experimental force distributions. Then the 3D thermo-mechanical FEM simulations of the same operations were realized by means of the Deform code and the results were compared to the previous ones. Finally the advantages of the different approaches have been presented and discussed.