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A model of milling dynamics using Matlab and Simulink

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Abstract

This paper gives an overview of a modelling approach for studying the stability of milling. The model is based upon that developed by Altintas and colleagues, with a number of developments which are summarized below:
Solution methodology. To enable a 'rapid prototyping' approach for model development, the model is formulated in a Simulink environment. The block diagram approach enables various types of nonlinear behaviour to be included, whilst maintaining a graphical visualization of the model hierarchy. Furthermore, various built-in numerical integration routines can be employed. However, for more extensive studies, many hundreds or thousands of solutions may be required, and for this purpose a novel computational cluster is employed. The Simulink model is first automatically compiled as a C-program using built-in software. The resulting executable is then used with different parameter files on a set of networked PC's. this allows a range of solutions to be computed simultaneously.
Process damping. The model has been modified to investigate this special aspect of milling dynamics, that limits the onset of undesirable chatter behaviour. The approach adopted is similar to that developed by Ranganath *et al*, except that the Simulink environment enables a variety of formulations to be developed, whilst retaining the efficient computational routines of the software.
Stability analysis. Finally, the Simulink modelling environment allows for an efficient implementation of a signal processing technique to determine the onset of chatter instability.

The paper describes the implementation of these aspects of the model, and compares the performance to previous models and experimental data.