5. Conclusions

Spindle-holder-tool assembly is one of the most important machine tool elements because its static and dynamic behavior, strength, speed, etc., have a significant impact on machine tools overall performance. Determination of the stable and unstable cutting zone in the machining process implies knowing stability lobe diagrams of spindle-holder-tool assemblies. For generation of these diagrams FRF of the spindle-holder-tool assembly should be achieved firstly using experimental modal analysis. However, tool point FRF is strongly depend on the individual components of the spindle-holder-tool assembly as well as their interactions. Tool geometry is very practical operational parameter which can be controlled by the user to alter the dynamics of the spindle-holder-tool assembly, by primarily altering the natural frequencies of the tool controlled mode.

The present work aims at estimating natural frequencies of the tool controlled mode of the spindle-holder-tool assembly using two different artificial intelligence methods, namely, ANN and ANFIS, as a tools for the prediction. Tool overhang length and tool diameter were considered to be the design variables. The natural frequencies of the tool controlled mode for limited combinations of tool overhang length and tool diameter were firstly identified experimentally. The obtained experimental results were used to develop ANN and ANFIS models for prediction of natural frequencies of tool controlled mode. Both models were compared for their prediction capability with the experimentally determined data. Regarding the results, ANN and ANFIS models were found to be capable of very accurate predictions of natural frequencies of the tool controlled mode, although ANFIS models give somewhat better predictions. Therefore, it can be concluded that ANN and ANFIS models can be used in the determination of the tool point FRF, and thus can be used for the generation of stability lobe diagrams.

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