Process model development and validation using artificial neural networks

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Abstract: Modelling and simulation are important analysis and presynthesis tools in engineering. Flat end milling processes are accurately modelled using Artificial Neural Networks (ANNs) and real experimentation. ANNs are expensive techniques, as they require enormous experiments over ranges of input parameters. This is crucial to any realistic modelling. Orthogonal Arrays (OAs) and Design of Experiments (DOEs) are used to remedy the modelling expense using Neural Networks (NNs). The high cost of ANNs is offset by combining DOEs with ANNs to model part of the domain instead of the full domain. The process variables include depth of cut (a), spindle speed (n), feed rate (f) and tool diameter (d). Our interest is in measuring the dynamic variations of the cutting forces and their time behaviour. Several experimental models are developed, including two-level, three-level, four-level and five-level OA-based models. The result is a valid neural model for flat end milling over realistic domains of process parameters.

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