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Prediction of burr height formation in sheet metal trimming processes using acoustic signals and an artificial neural network

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Abstract: Sheet metal trimming is an important manufacturing process in various industries. In trimmed components, burr formation is a significant defect, and the burr height is a key determinant of product quality. Punch wear and punch-die clearance are the two main factors affecting burr formation. An online burr height prediction system is required to improve the productivity of the process. In this research, the human hearing system was imitated for burr height prediction during trimming. Firstly, a discrete wavelet transform with the mel-frequency cepstral coefficients was employed to extract features from an acoustic signal. Subsequently, a feed-forward back-propagation artificial neural network was trained to determine the changes in the sheet metal thickness and punch wear state and to predict the burr height using the signal features. The proposed online burr height prediction system can improve productivity by mitigating defective production, reducing inspection time, and enabling timely regrinding of components.

Keywords: sheet metal trimming; mel-frequency cepstral coefficients; ANN; artificial neural network; acoustic emission; condition monitoring

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