# MACHINING ACOUSTICS: SIGNAL PROCESSING AND DEEP LEARNING AS A TOOL FOR PROCESS MONITORING

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## ABSTRACT

*The requirements of Industry 4.0 and beyond go hand in hand with adaptive, intelligent process control through the application of some form of AI. To this end, some acoustic phenomena have been observed in this series of research conducted over the last few years. Noise analysis for different working conditions of circular saw blades was investigated in this study. The main objective of this work was to verify the existing relationships between the recorded noise patterns and the corresponding operating conditions of different circular saw blades. This goal was achieved by analysing noise signals and using different neural network architectures, such as GoogleNet, MobileNetV2, VGG19, DenseNet, SqueezeNet, ResNet and InceptionV3. The results obtained in this series of investigations suggest that the noise generated during cutting can be used as a tool for process monitoring with high accuracy. Various cases are presented in this paper, such as determining the speed of the same saw, recognising different types of saws idling at different speeds, recognising types of wood being processed with the same saw, and idling the same type of saw at different bluntness and utilisation. In all cases presented, the trained neural networks showed a relatively high accuracy in determining the observed output.*

**Keywords:** acoustic signal, circular saw blade, wood machining, process monitoring, decision making, deep learning network.