

Analysis of an Air Borne Acoustic Signatures from Welding Process Using Empirical Mode Decomposition

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ABSTRACT

This work present the application of Empirical Mode Decomposition (EMD) to analyze the air borne acoustic signatures commenced during welding process. In order to achieve goals, bead-on plate welding was done onto the carbon steel specimen using Metal Inert Gas Welding. At the same moment, the microphone with operating frequency of 31.5 Hz to 8 kHz used to collect air borne acoustic signatures. In analysis part, Empirical Mode Decomposition has been applied to the acoustic signals and the selected Intrinsic Mode Function (IMF) was presented in frequency-distance plot using spectrogram. Based on the analysis results, there were 3 significant IMF has been found. Those were IMF mode 3, mode 5 and mode 8 which lie within the frequency of 1500 Hz to 4500 Hz, 200 Hz to 800 Hz, and 40 Hz to 80 Hz respectively. The frequency-distance plot from spectrogram of IMF mode 3 showed a significant pattern which can be related with the discontinuity of welding. The discontinuity appears wherever low amplitude power detected in the frequency-distance plot of IMF mode 3. Moreover, the frequency-distance plot of IMF mode 5 and mode 8 can be significantly related with the spatter and weld pool oscillation condition. High power amplitude in frequency-distance plot of IMF mode 8 can indicates the offset of weld pool oscillation frequency and cause the existence of higher amount of spatter which resulting the high power amplitude in frequency-distance plot of IMF mode 5. In summary, it can be conclude that the application of EMD in the analysis of air borne acoustic signatures allow the detection of several phenomena in welding process which might lead to defect once in a time. This was found to be significant in the process of developing the online welding quality monitoring.

KEYWORDS: Air Borne Acoustic Signatures, Empirical Mode Decomposition (EMD), Welding

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