Analysis and Prediction of Cutting Speed for machining Slant triangular slot on Hastelloy X using WEDM

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1. Introduction

Wire electric discharge machining (WEDM) is a non-conventional metal removal process that is used for precision machining of hard materials. The oblique and tapered form of precise components as many applications like dies, moulds, inserts, cutting tools and other components [1]. There are many disadvantages of traditional tapering in WEDM like wire breakage, wear of guideways, inaccuracies in case of angular cutting and poor surface due to insufficient flushing [2, 3]. A unique fixture is developed to obtain tapered precise angular or slant machined components. This fixture avoids bending of wire and ensuring uniform flushing which leads to effortless machining of tapered component avoiding wire breakage. Different output parameters have to be studied during slant type machining for optimal economic results. Cutting speed becomes an important output parameter as it influences many surface properties and productivity during machining [4].

2. Body of abstract

In the present study, simple slots were machined using a slant type fixture to achieve a tapered surface as shown in fig.1 (a) and (b). An attempt has been made to study the effects of the machining parameters like wire guide distance, wire offset, corner dwell time and cutting speed override (CSO) on cutting speed of machined profiles on Hastelloy X. Hastelloy X is a nickel-chromium-iron-molybdenum alloy which is employed in many application from flame holders, afterburners, tailpipes to dies, moulds etc. The material of uniform thickness 10mm is used throughout the machining.

The tapered triangular slots were machined at 0°, 15° and 30° slant angles as shown in fig.2. Taguchi's L16 orthogonal array was designed to study the effects on cutting speed during machining. The cutting speeds were recorded for all the profiles and the main effect plots were plotted. It is observed from ANOVA that the CSO parameter is the most contributing and significant factor on cutting speed for all the slant angles. The cutting speeds were predicted using an artificial neural network model (ANN). The validation experiments were performed and the errors ranged approximately from 2-15% compared to predicted cutting speeds.

3. Figures

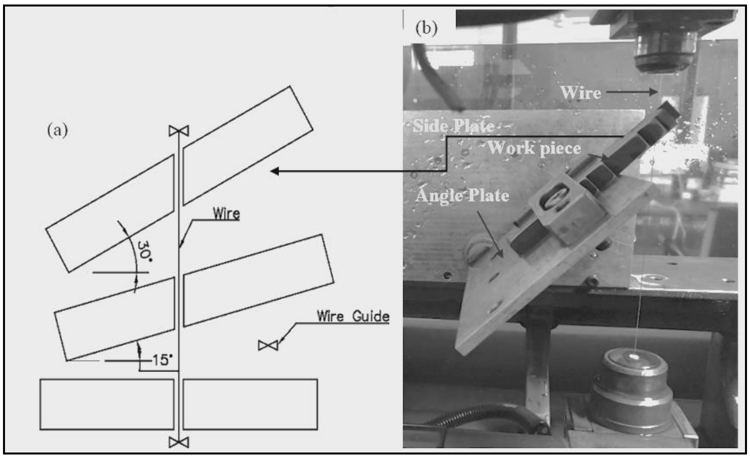

Fig.1 (a) Work piece at different slant angle by slant fixture (b) Slant Fixture

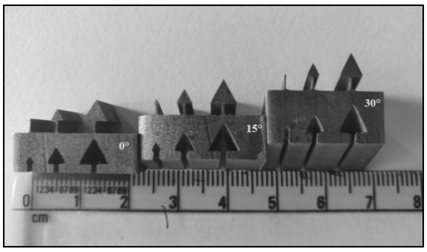

Fig.2 Specimens at different slant angle by slant fixture.

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