

Incremental sheet forming (ISF) of AISI 316 stainless steel sheet using CNC milling machine

ABSTRACT

Incremental sheet forming (ISF) is a method to form a sheet metal into desired shape and surface features in a batch production series. This method includes forming a clamped sheet metal in controlled conditions by a CNC milling machine, lathe machine or a robot. In this study, the effects of forming parameters on the amount of stretch in stainless steel sheet using a CNC milling machine have been investigated. A ball-point shaped tool made of a bronze alloy was fabricated and used throughout the experiments. The tool acted as the indenter that formed the stainless steel sheet into a small pyramid-like shape. The results showed that as the spindle speed and feed rate increased, the amount of sheet stretch also increased, up to a point where the sheet could not stretch anymore and the process changed from forming to shear thinning and chipping. In addition, the surface quality of the part was badly affected at higher spindle speed and feed rate settings. The temperature of the lubrication oil was also measured during the process and the maximum temperature recorded was 45°C which remained constant until the end of the process. In conclusion, to obtain a good quality part while increasing the productivity of ISF, the optimized values of the feed rate and spindle speed in this work were found to be at 500 mm/min and 1000 rpm respectively.

Keyword: Forming; Incremental; ISF; Milling