Parametric optimization of robot-based single point incremental forming using Taguchi method

ABSTRACT

Sheet metals forming process is widely used in consumer and industrial products. However, the conventional sheet metal forming has low flexibility and product quality. It also prolongs the time-to-market in producing prototype products that required low costs. Single point incremental forming (SPIF) is one of relatively new sheet metal forming process. The increase interest in new techniques for forming processes and the usage of robotics in the industry has created more researches on the SPIF. Robot based SPIF is a method of deforming a sheet metal to create designed workpieces by utilising a forming tool that attached to an industrial robot. In this present work, an optimization study for combination of process parameters in robot-based single point incremental forming of aluminum alloy sheet was experimentally investigated using Taguchi method to achieve an excellent surface roughness. A number of forming experiments were conducted using the L18orthogonalarray.Analysis of Variance (ANOVA) was used to identify the most significant process parameters affecting the surface roughness. The results analysis indicates that the optimum process parameters for surface roughness are obtained as 0.3 mm of step size, 150 mm/s of robot speed and 45 degree of wall angle. The most significant process parameter is step size and followed by robot speed. The study revealed the surface quality could be improved by proper selection of process parameters.

Keyword: Single point incremental forming (SPIF); Optimization; Taguchi method; ANOVA; Robot