Machinability performance of Al–NiTi and Al–NiTi–nano SiC composites with parametric optimization using GSA

ABSTRACT

The manuscript discusses the abrasive water jet machining (AWJM) of Al–NiTi and Al–NiTi–nano SiC composites to understand the influences and the effect of each parameter and to indentify optimal combination of AWJM parameters. The experiments are planned and conducted based on L27 orthogonal array. Pressure, standoff distance, and transverse feed rate are considered as input parameters; surface roughness and kerf angle are considered as output parameters. Gravitational search algorithm (GSA) is employed to identify the best possible combination of AWJM parameters. Regression model is used to develop the surface roughness and kerf angle model for Al–NiTi and Al–NiTi–nano SiC composites. The developed mathematical model is used as fitness function in GSA. It is found from the result of GSA that the optimal value for surface roughness of Al–NiTi composite is set at pressure 176 kPa, standoff distance 1 mm, and transverse feed 20 mm/min and for Al–NiTi–nano SiC composite is set at pressure 180 kPa, standoff distance 1.1 mm, and transverse feed 20 mm/min. Similarly, for kerf angle, the optimal value for Al–NiTi composite is set at pressure 260, standoff distance 1 mm, and transverse feed 20 mm/min and for Al–NiTi–nano SiC composite is set at pressure 255 kPa, standoff distance 1 mm, and transverse feed 20 mm/min. Analysis of variance is also performed to understand the effect of each input parameter on output response.

Keyword: Al–NiTi; Al–NiTi–nano SiC; AWJM; Surface roughness; Kerf angle; GSA; Regression; Mechanical properties