Machinability study of glass fibre-reinforced polymer composites during end milling

Abstract

Machining of composite materials is usually performed to achieve required geometrical shapes and dimensional tolerances. However, machinability evaluation of glass fibre-reinforced polymer (GFRP) composites in end milling has not yet received its due attention in the research community despite the extensive industrial use of this process. This work aims to elucidate the end milling machinability of GFRP composites with respect to surface roughness, tool life and machining forces. Experiments were conducted under different experimental parameters and their levels according to the Taguchi design of experiment method. Taguchi analysis combined with statistical analysis of variance (ANOVA) was performed to quantify the effects of spindle speed, feed rate and depth of cut on those characteristics. Multiple regression analysis (MRA) was also employed to establish parametric relationships between the experimental parameters and the machinability outputs. Results from ANOVA and MRA reveal that feed rate is the governing factor affecting all the machinability outputs. The calculated values from MRA have been found to be fairly close to experimental values in almost all cases. Validation tests under randomly selected machining conditions have further demonstrated the feasibility of the developed mathematical models with 8–12% error for tool life and machining forces predictions while >19% error for calculating the surface roughness.