Assessment of Induced Delamination During End-Milling of Natural Fiber Reinforced Composites: A Statistical Analysis

Abstrace:

The use of natural fiber reinforced composites has emerged as an advantageous option in many industrial applications. Generally, composites are manufactured in net or near-net shape, but under specific design specifications, secondary manufacturing processes such as drilling, milling and turning become a requirement. In this context, current paper presents an experimental study that investigates the machinability of newly developed natural fiber composites under conventional end-milling. Two types of bio-composites; date palm fronds reinforced polypropylene (DPF/PP) and pine needles reinforced polypropylene composite (PN/PP) were developed and physically tested in order to optimize their mechanical strength. Then, machinability of such class of bio-composites is statistically analyzed using Design of Experiment method. Statistical modeling including response surface plots are utilized to analyze the combined effect of input processing parameters (feed rate, axial depth, spindle speed) on the induced delamination during end-milling. It is shown that feed rate is the most dominant factors in DPF/PP milling, and axial depth of cut is the most significant factor on PN/PP milling. Results are also compared with those of milled neat polypropylene, which confirm that delamination of machined bio-composites can be improved over the neat polypropylene matrix. This qualifies the developed bio-composites to be used in industrial applications in which machining is required.