

# Machinability analysis and multi-response optimization using NSGA-II algorithm for particle reinforced aluminum based metal matrix composites

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## ABSTRACT

In this study the effects of reinforcement particle size and cutting parameters on machining performance variables like cutting force, maximum tool-chip interface temperature and surface roughness of the machined surface have been investigated while machining Aluminum based metal matrix composites (MMCs). MMC bars with silicon carbide reinforcement having 10 % volume fraction and particle sizes of 5 µm, 10 µm and 15 µm are machined with polycrystalline diamond (PCD) inserts. Experiments are performed using central composite design (CCD) having four parameters with three levels. Response surfaces for each performance variables are generated using polynomial models. Single variable and interaction effects have been investigated using principal component analysis and 3D response charts. Multi-response optimization has been performed to minimize surface roughness and maximum tool-chip interface temperature using non-dominated sorting genetic algorithm II (NSGA-II). In addition, constraints have been applied to the optimization search to filter design points with high cutting forces and low material removal rate. Most of the optimal solutions are found to be with moderate cutting speeds, low feed rate and low depth of cuts.

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