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Simultaneous Optimization of Correlated Multiple Surface Quality Characteristics of Mild Steel Turned Product

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ABSTRACT

Present work highlights application of utility theory combined with Principal Component Analysis (PCA) and Taguchi ' s robust design for simultaneous optimization of correlated multiple surface quality characteristics of mild steel machined product prepared by straight turning operation. The study aims at evaluating the most favorable process environment followed by an optimal parametric combination for achieving high surface quality. Traditional Taguchi based hybrid optimization approaches rely on the assumption that quality indices are uncorrelated or independent. But it is felt that, in practice, there may be some correlation among various quality indices (responses) under consideration. To overcome this limitation of Taguchi approach, the present study proposes application of PCA to convert correlated responses into uncorrelated quality indices called principal components. Finally based on utility theory, Taguchi method has been applied to solve this optimization problem. The study demonstrates detailed methodology and concludes robustness and flexibility of the proposed optimization technique and validates its effectiveness through a case study in which correlated multiple response characteristics of turning operation have been optimized.

KEYWORDS

utility theory, principal component analysis, Taguchi ' s robust design, straight turning

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