

Optimization of multiple quality characteristics for injection moulded polyamide helical gear via integration of Taguchi method and Grey relational analysis

Abstract

Considering the great importance of injection moulding in plastic gear manufacturing, it is momentous to effectively control all the influential factors in the plastic injection moulding industry to improve the quality characteristics of the final gear part. As plastic materials exhibit extremely convoluted properties, the complexity of the injection moulding process makes it very challenging to attain the desired gear part properties. Since the intricate injection moulding process produces a wide range of parts with complex shapes within very narrow limits of tolerances, requires a great effort in order to keep the quality characteristics of moulded gears under control. In fact, the optimum properties of the plastic material cannot be achieved even with the most innovative part and mould design, and become meaningless without optimized processing parameters during the gear manufacturing. Therefore, the aim of this study is to propose the integration of Taguchi method/Grey relational analysis optimization approach in designing the gear part, setting up processing parameters, and selecting a suitable material for a helical gear via numerical simulation. The findings implied that an experimental design based on the integration of numerical simulation and Taguchi/Grey relational analysis is capable to enhance the multi-quality characteristic of the helical gear.