ABSTRACT

Widespread application of Inconel alloys in manufacturing industries especially in the automobile as well as aerospace industries leads to manufacturers to pay more attention towards the understanding of machinability aspects of these alloys. As the need for large-scale manufacturing of Inconel machined components made of Inconel alloys arises optimization of machining process variables becomes crucial to produce quality products economically using enhancing process performance. Generally, several process parameters namely depth of cut, feed rate, and spindle speed influence the performance of turning operation in their own way. Concurrently, in the machining of Inconel alloys, the important performance indices are material removal rate (MRR), surface roughness, and cutting force. This work deals with the assessment of machinability of Inconel 825 alloy during turning operation. The work also utilizes the Grey Relation Approach and several evolutionary optimization approaches to assess the optimized machining condition.The present work assesses the influence of feed rate as well as nose radius on machinability criteria such as surface roughness parameters, cutting force, chip thickness ratio, specific cutting energy and apparent coefficient of friction during dry machining of Inconel 825. Turning operation was carried out using coated carbide inserts with a constant spindle speed of 337 RPM and depth of cut of 0.8 mm. Results indicate that minimum nose radius insert with low feed provides better surface finish whereas sharp nose with low feed generates low resultant machining force. It has been also observed that chip thickness ratio decreases with an increase in feed whereas the apparent coefficient of friction increases with an increase in feed and nose radius. For optimization of multiple responses, grey relation analysis has been employed that transforms the

multiple responses into an equivalent single response known as overall grey relation index (OGI). Considering OGI, as a function of selected process variables, a non-linear regression model has been developed and used as a fitness function during the optimization process.

Key words: Inconel 825, Nose radius, feed rate, apparent coefficient of friction, Rao1, Rao2, Rao3, JAYA, TLBO.