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## TRIZ approach for machining process innovation in cryogenic environment

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### Abstract

This paper presents the utilisation of TRIZ approach in machining process of AISI 4340 in cryogenic environment which lead to product improvement in turning process. The machining study is carried out in two stages; FEM simulation for finding the optimum condition and machining experiment to visualise the product improvement that involved plastic deformation. The simulation result revealed that at moderate to high cutting speed, high feed rate and high depth of cut will result in high temperature that enable for the change in phase of AISI 4340 from retained austenite to fully martensite. A sample from machining experiment at optimum cutting condition found that the microstructure changes beneath the machined until at the depth of similar to 7 µm with high hardness to 8,500 N/mm<sup>2</sup> Martens hardness at the machined surface. This hardness is equivalent to the hardness obtained in conventional case hardening process that is required after the machining of AISI 4340 in their application as automotive engine parts in order to enhance these parts in their service lives. This study reveals that the TRIZ approach helps to systematically analyse the various outcomes in this study started with process limitation, problem identification, axiomatic and Su-field analysis.

### Keywords

**Author Keywords:** TRIZ; machining process for product improvement; cryogenic turning; high hardness

**KeyWords Plus:** CUTTING FORCES; ALLOY; TOOL

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