

# Modelling and simulation of hot direct extrusion process for optimal product characteristics: Single and multi-response optimization approach

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## ABSTRACT

The study of eccentricity minimization in cylindrical products helps to reduce the mechanical vibrations and wear of related mechanical parts such as bearings, columns and gears which positively affects in maintenance costs savings and increasing production quality reliability. The main purpose of this paper is to investigate the effect of the eccentricity between the billet material and the die parts on the quality of the final product in the direct extrusion process. The input parameters to produce a cylindrical product shape are optimized in MINITAB based on Taguchi method and ANOVA. The selected material of the billet is the aluminium alloy AA2024, and the die material is Steel H13. The inputs parameters are the temperature, the die angle, the ram speed, and the presumed eccentricity. The finite element model of the process is simulated in DEFORM-3D for providing the extrusion information such as the pressure, the effective stress and strain, the final product eccentricity, and the roundness error. The study is carried out on two cases of the presumed eccentricity in addition to a case of zero eccentricity. The single and multi-response optimizations are executed to obtain the optimum parameters for the minimum product eccentricity and roundness error.

## ARTICLE INFO

### Keywords:

Metal forming;  
Hot direct extrusion;  
Eccentricity;  
Roundness;  
Modelling;  
Simulation;  
Optimization;  
Single response;  
Multi-response;  
DEFORM-3D;  
MINITAB

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### Article history:

Received 11 January 2022

Revised 25 February 2022

Accepted 28 February 2022



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