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Flow forming optimization based on diametral growth using finite element method and response surface methodology

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Abdolhossein Jalali Aghchai[1], Nabi Allah Razani[2] and Bijan Mollaei Dariani[3]

Abstract
Flow forming as a precise locally plastic deformation is applied to fabricate thin-walled seamless tubes. Diametral growth as a dimensional defect that occurrs in a flow-formed tube is studied numerically and experimentally in this article. Flow forming of an AISI 321 steel tube is investigated using a finite element method with a dynamic explicit approach. The efficient parameters on the diametral growth are determined using experimental outcomes. The parameters considered are the thickness reduction (%), the feed rate of the roller (mm/min) and the roller nose radius (mm). Response surface methodology is employed to draw out a mathematical model of the diametral growth with regard to the significant parameters. The gained equation reveals that the thickness reduction is the most significant parameter and feed rate has the slightest effect on the diametral growth. The diametral growth increases with the rise in the thickness reduction and the roller nose radius and it leads to a decrease with a high value of feed rate. The innovation point of view is related to the fact that the high level of roller nose radius covers the efficiency of feed rate.

Keywords
Flow forming, diametral growth, response surface methodology