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Analysis of Friction Steel Welding Process Considering Multiple Categorical Defects

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Abstract: Some materials used in aeronautical industry have been proposed to be used in automotive industries due to its high quality standards. Then, for harnessing those materials adequately, it is necessary to apply alternative welding process like friction stir welding (FSW), since it does not affect welded joints with heat input. In that sense, it is of interest to model FSW process to understand the relationships between process parameters and quality of welded joints. In order to avoid useless destructive tests costs, the first step to assess the quality of welded joints is the visual inspection, which results in one or more categorical defects as responses: warm hole, tool-hole and flashing. In this paper, multinomial distribution generalized to regression model is proposed to model the FSW process considering categorical defects. The model is fitted by likelihood method and AIC statistic is used to select the model to perform better the FSW behavior. Finally, a multicriteria optimization was applied to minimize the probability of finding these categorical defects.

Keywords: Friction Steel Welding, Multinomial Distribution, Generalized Linear Models, Multicriteria Optimization