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Characterising the Dynamic Friction in the Staking of Plain Spherical Bearings

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Abstract : Anvil Staking is a cold-forming process that is used in the assembly of plain spherical bearings into a rod-end housing. This process ensures that the bearing outer lip conforms to the chamfer in the matching rod end to produce a lightweight mechanical joint with sufficient strength to meet the pushout load requirement of the assembly. Finite Element (FE) analysis is being used extensively to predict the behaviour of metal flow in cold forming processes to support industrial manufacturing and product development. On-going research aims to validate FE models across a wide range of bearing and rod-end geometries by systematically isolating and understanding the uncertainties caused by variations in, material properties, load-dependent friction coefficients and strain rate sensitivity. The improved confidence in these models aims to eliminate the costly and time-consuming process of experimental trials in the introduction of new bearing designs. Previous literature has shown that friction coefficients do not remain constant during cold forming operations, however, the understanding of this phenomenon varies significantly and is rarely implemented in FE models. In this paper, a new approach to evaluate the normal contact pressure versus friction coefficient relationship is outlined using friction calibration charts generated via iterative FE models and ring compression tests. When compared to previous research, this new approach greatly improves the prediction of forming geometry and the forming load during the staking operation. This paper also aims to standardise the FE approach to modelling ring compression test and determining the friction calibration charts.

Keywords : anvil staking, finite element analysis, friction coefficient, spherical plain bearing, ring compression tests
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