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Advanced Model for Calculation of the Neutral Axis Shifting and the Wall Thickness Distribution in Rotary Draw Bending Processes

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Abstract : Rotary draw bending is a method which is being used in tube forming. In the tube bending process, the neutral axis moves towards the inner arc and the wall thickness distribution changes for tube's cross section. Thinning takes place in the outer arc of the tube (extrados) due to the stretching of the material, whereas thickening occurs in the inner arc of the tube (intrados) due to the comparison of the material. The calculations of the wall thickness distribution, neutral axis shifting, and strain distribution have not been accurate enough, so far. The previous model (the geometrical model) describes the neutral axis shifting and wall thickness distribution. The geometrical of the tube, bending radius and bending angle are considered in the geometrical model, while the influence of the material properties of the tube forming are ignored. The advanced model is a modification of the previous model using material properties that depends on the correction factor. The correction factor is a purely empirically determined factor. The advanced model was compared with the Finite element simulation (FE simulation) using a different bending factor (Bf=bending radius/ diameter of the tube), wall thickness (Wf=diameter of the tube/ wall thickness), and material properties (strain hardening exponent). Finite element model of rotary draw bending has been performed in PAM-TUBE program (version: 2012). Results from the advanced model resemble the FE simulation and the experimental test.

Keywords : rotary draw bending, material properties, neutral axis shifting, wall thickness distribution
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