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Abstract
Straightness and concentricity precision of round or equilateral shaped bars can be improved by cold skin-pass drawing. However the workpiece tends to deform inhomogeneously and causes residual stress with the intuitive large numbers of the delta parameter in the skin-pass process. And these factors cause bending and twist on the workpiece after subsequent heat treatment.

The current work first applies FEM software DEFORM 2D to analyze the drawing force of the skin-pass bar drawing. Optimum die semi-angles are evaluated for the process subject to a combination of various die semi-angles, reductions of area and friction factors. Distributions of displacement and effective strain are further analyzed with the same combination of process parameters. “Inhomogeneity factors in strain” are defined in order to evaluate the influences of the process parameters on deformation inhomogeneity.

The second part of the work is devoted to the analyses of skin-pass drawing of equilateral shaped bars. Optimum die semi-angles are evaluated for the process subject to a combination of various shape profiles, die semi-angles and reductions of area, with DEFORM 3D. The influence of the various process parameters on the distribution of effective strain is evaluated as well. The simulations show the corners of the shaped bars attract the most strain and hence the distribution of the effective strain across the centerline to the corner is utilized for the analyses of inhomogeneity factor in skin-pass drawing of equilateral shaped bars. The results from the round and equilateral shaped bars can serve as the guidelines for the analyses of skin-pass bar drawing of rectangular or irregular cross-sections.
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