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Numerical analysis of the manufacturing process of an extruded product

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This paper presents the finite element analysis of forward extrusion process of a metallic rod. Extrusion takes place at ambient temperature. Due to plastic deformation and friction occurring during deformation, heat is released, this being taken into account during simulation. The process is represented by an axisymmetric model and heat transfer is calculated using the coupled analysis. The punch speed is constant and has a value of 0.45 mm/s. The punch and the workpiece are modeled as deformable bodies, and the die is defined as a rigid body. The analysis highlights the stresses and strains developed in the process in the extruded product, but also the stresses and strains occurring in the work tools, punch and die. Three different cases of extrusion dies were simulated. Elastic strains in the dies, for all three cases considered, are low, about 0.5 μm; it shows that the dies were well designed, are rigid and provide enough precision for the extruded product. The analysis of the numerical results, obtained for different geometrical dimensions of the work tools, allowed the optimization of the studied manufacturing process. The numerical results were compared with experimental results to validate the finite element model designed. In the case of simulated direct extrusion process, I found a good agreement between the data obtained using the numerical model and the data obtained from the experiments performed.

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