Automated groove pass (pre-)design and optimisation of symmetrical and asymmetrical wires and pro les

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To understand the material flow and behaviour during the production of shaped wires different simulation approaches like the finite element method or the pillar theory [1-2] are available, the latter ones enables optimisation routines due to high accuracy and geometric flexibility at low computing speeds. Semi-automated optimisation programmes of the groove pass can only map the forward calculation process - the upstream backward design with an initial pass sequence is carried out using empirical manufacturing rules [3-5]. A numerical description of the groove contour is necessary and complicated due to the high number of degrees of freedom of the groove geometry. Within this work, model approaches for automated groove pass (pre-)design and optimisation are demonstrated. Based on rolling tests carried out in breakdown passes as well as selected asymmetrical shaped profiles, correlations have been investigated to obtain an automatic backward calculation and groove pass predesign. Mathematical design guidelines as well as different target intervals of relevant degrees of freedom, e.g. coefficient of elongation, their distributions and geometric values of the respective profiles, are derived which are used as boundary conditions for subsequent optimisation procedures. The challenges which arise due to the asymmetry of the profile contour are presented and considered for shape profiles. The methodology is shown by breakdown passes as well as for Z-profiles, whereby the approach can be transferred to other profiles.