Evaluation of multiple reshaping operations via model order reduction

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ABSTRACT

In previous works, reshaping of large aeronautical parts distorted due to residual stresses was studied [1]. A real-time simulation model based on multi-parametric solutions was proposed, where different technological parameters for bending straightening were explored in combination with the residual-stress free hypothesis, which allowed using the distorted geometry as the main input (instead of residual stresses which are not measurable in practice) [2]. By including the initial distortion as an extra coordinate, the restriction of not knowing beforehand the warped geometry was overcome, which is the first requirement to start a reshaping study. Additionally, it was possible to find and select the optimum combination of parameters (e.g. roller positions and imposed vertical displacement) to minimize the remaining distortion, which allows us to analyse different *what-if* scenarios before launching the real reshaping operation, following the methodology described in [3].

However, only single-step reshaping operations were considered in our previous works, whereas in practice reshaping operations are much more complex, involving multiple reshaping steps. In the present study, the goal is to chain two or more consecutive reshaping steps. The main challenge relies in the fact that the output of a given operation must be passed as input to the next model [4]. By constructing a multi-steps reshaping solution, besides evaluating the technical parameters involved during the operation, it is possible to evaluate different reshaping strategies with the aim to reduce the uncertainty during the decision-making when choosing the next reshaping step.

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