Introduction

ELDIM manufactures among others stator vanes for the compressor of an aero engine (figure 1). These vanes are produced from strips of sheet metal by a cold rolling process. The development of a rolling process for a new type of vane can take several cycles of trial and error, before all requirements are fulfilled.

Objectives

The objective of this research is to build a model that gives more insight in this rolling process, which should accelerate the development of the rolling process for new vane types.

The rolling process

The roll-die and die-plate contain respectively the convex and concave airfoil profile of the vane. Due to the applied horizontal force, the die-roll rolls over the die-plate, deforming a strip (clamped in the die-plate) into a vane.

FEM model

The rolling of straight vanes can be considered as a stationary process. The ALE formulation in the Finite Element Method code DiekA is suitable for such processes [2]. Starting from an estimated initial geometry the steady state geometry is calculated. The tools are modelled rigid.

Results

The calculated deformation of the material agrees with the measured deformations (figure 4). A parameter study is performed with different friction coefficients and initial strip dimensions.

Future work

The model will be extended to be able to simulate real (non-symm.) vane profiles. Furthermore the elastic deformation of the tools has to be taken into account.

References


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