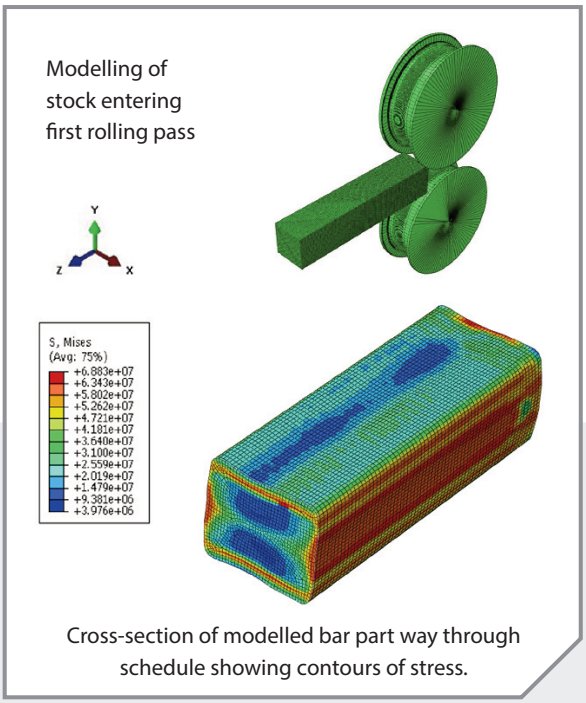
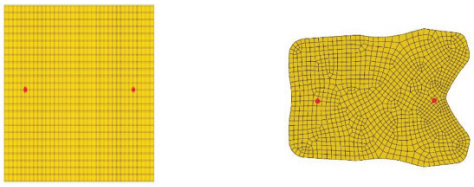
Materials Processing Institute

CASE STUDY

Finite Element Modelling to Support Roll Pass Design



Cross-section of modelled bar part way through schedule showing contours of stress.



Tracking of points through rolling schedule

THE PROJECT

The client was planning to cast larger blooms and wanted to know the effect that the increased stock size would have on the rail mill. Using a larger feedstock could lead to high rolling loads, or could entail any segregation defects in the bloom migrating to a critical part of the rail. Finite element models were produced to compare the current and proposed new rolling schedules.

THE RESEARCH

A finite element simulation of the early passes of a section rolling was created which enabled the product shape, rolling load, and rolling torque to be predicted. In addition, internal locations, which corresponded to possible centre-line segregation, were tracked through the schedule.

The client provided the dimensions, steel grade and temperatures of the feedstock together with roll drawings and pass schedules of the mill.

The finite element model was designed with the rolls constructed as non-deformable rigid bodies and the feedstock as deformable bodies with temperature dependent physical properties.

Each pass was modelled separately with the output from the previous pass used as the input for the next one. It was also possible to model the stock temperatures during rolling, using an uncoupled temperature model between each pass.

THE OUTCOME

The client was able to use the results to validate the pass design and to ensure that any centre-line segregation did not end up in critical regions of the product. A redesign of one of the roll grooves was proposed.

Rolling loads were predicted to be within the mill's capability.

BENEFITS

The client gained the knowledge that it could increase the cast bloom sizes without affecting the product and having only a small impact on production for the largest blooms.

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