




Ministério da Educação
Universidade Federal do Paraná
Setor de Tecnologia
Programa de Pós-Graduação em Engenharia Mecânica (PGMec)



- Workgroup Leader
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Goal:



To improve the **computational prediction** of the **springback** for Advanced High Strength Steel - **AHSS**.

through the implementation during modeling

of factors that take into account the mechanical material properties variation during forming.

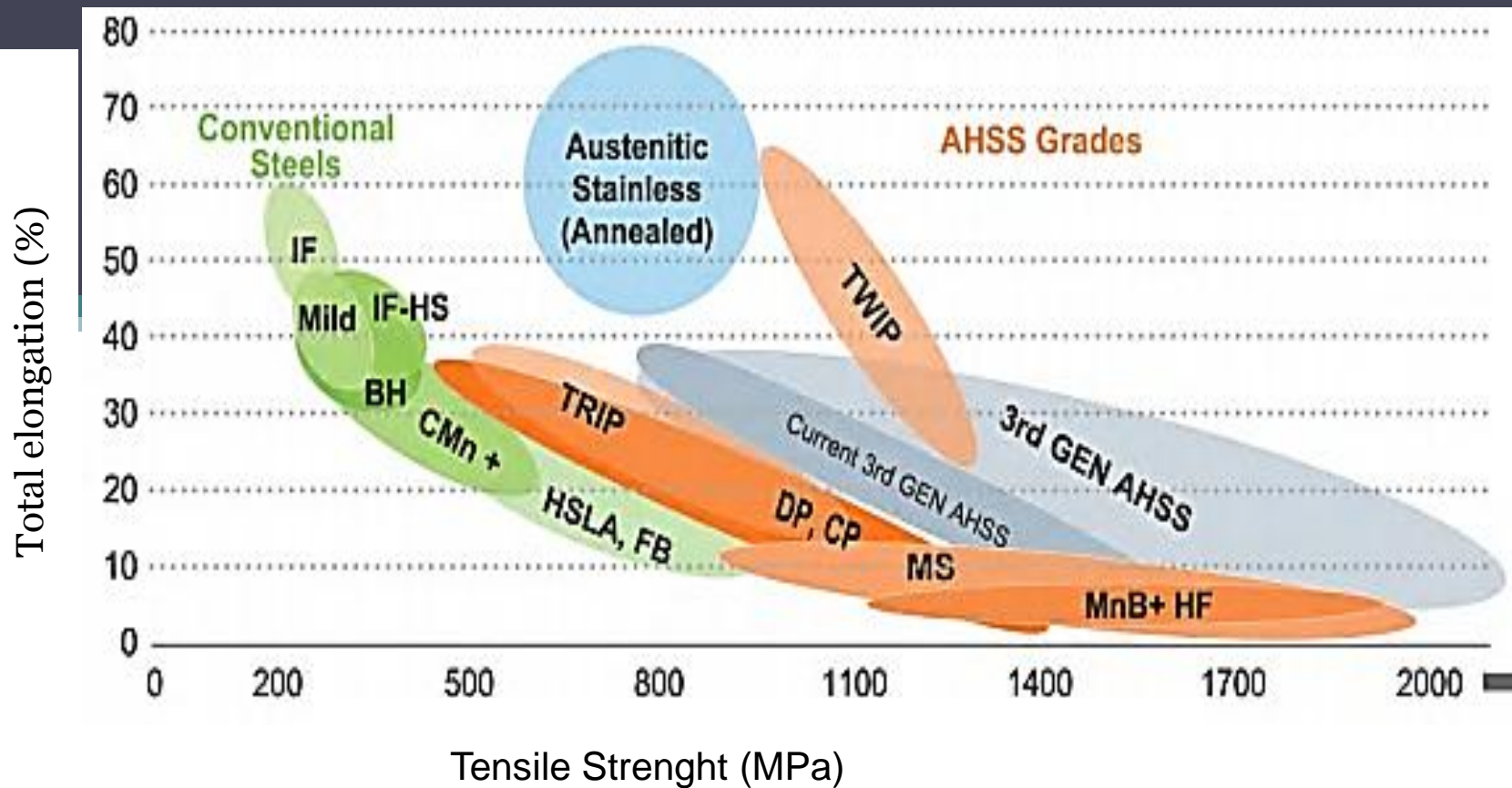
THE MECHANICAL PROPERTIES INFLUENCE ON PREDICTION OF SPRINGBACK FOR AHSS



Springback according to the material grade

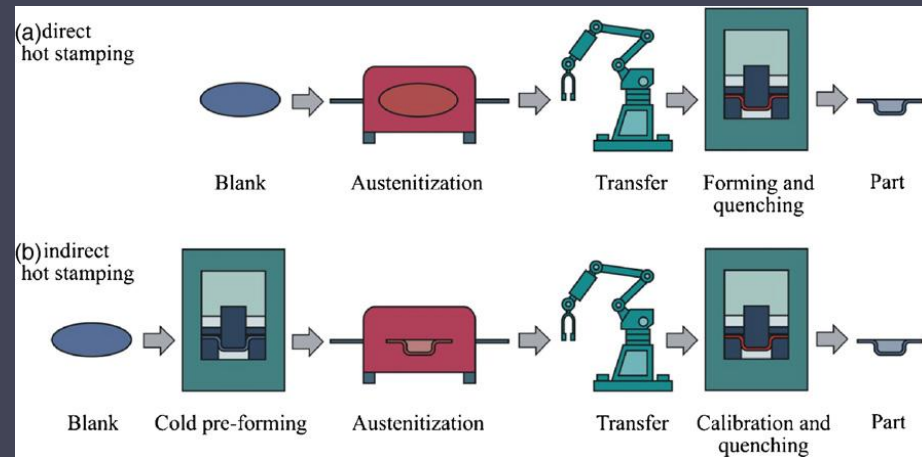
(WorldAutoSteel, 2014)

Lightweighting: What's a next?



(World Auto Steel, 2014)

INFLUENCE OF TEMPERATURE IN DEEP DRAWING



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Temperature can minimize springback but it will affect the FLC.

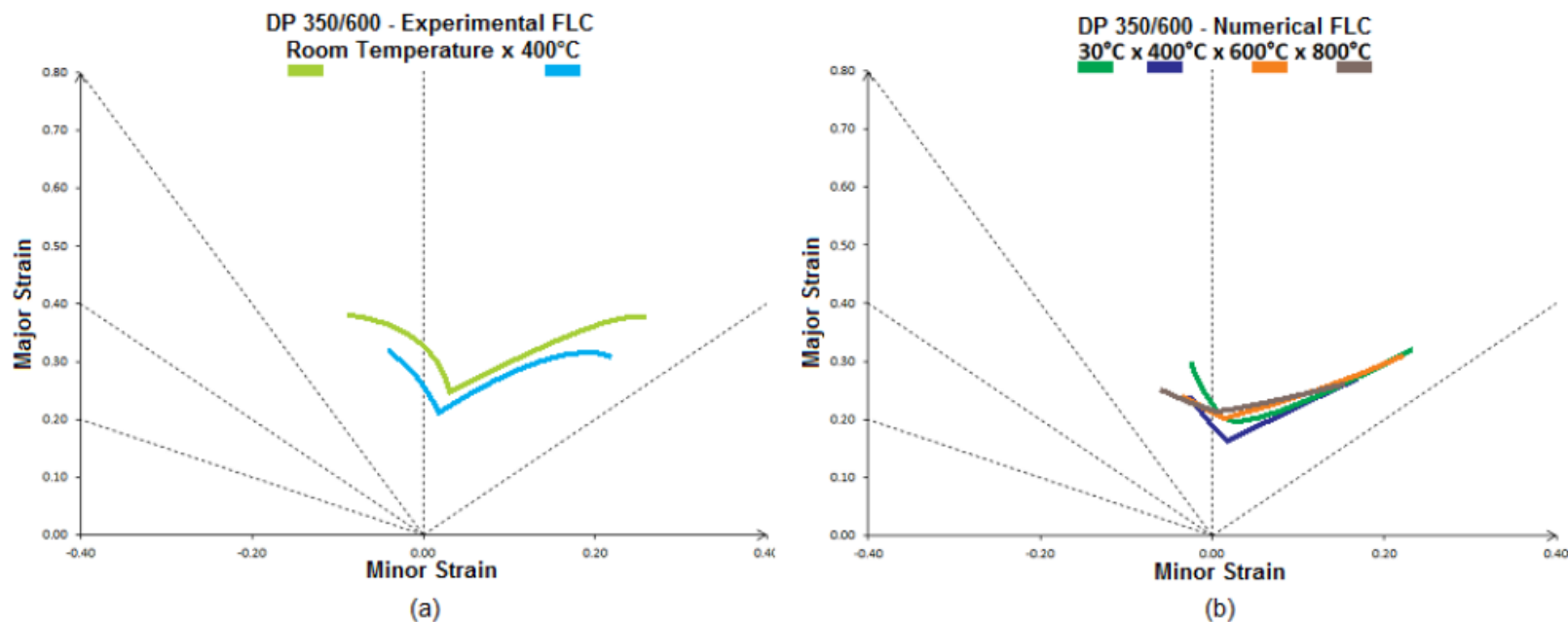
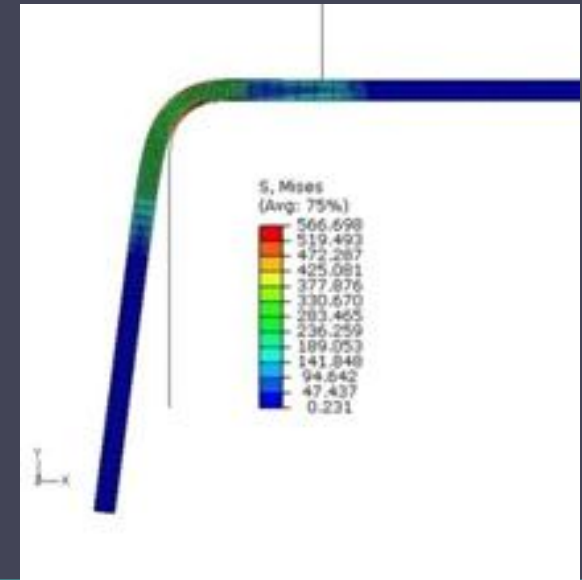


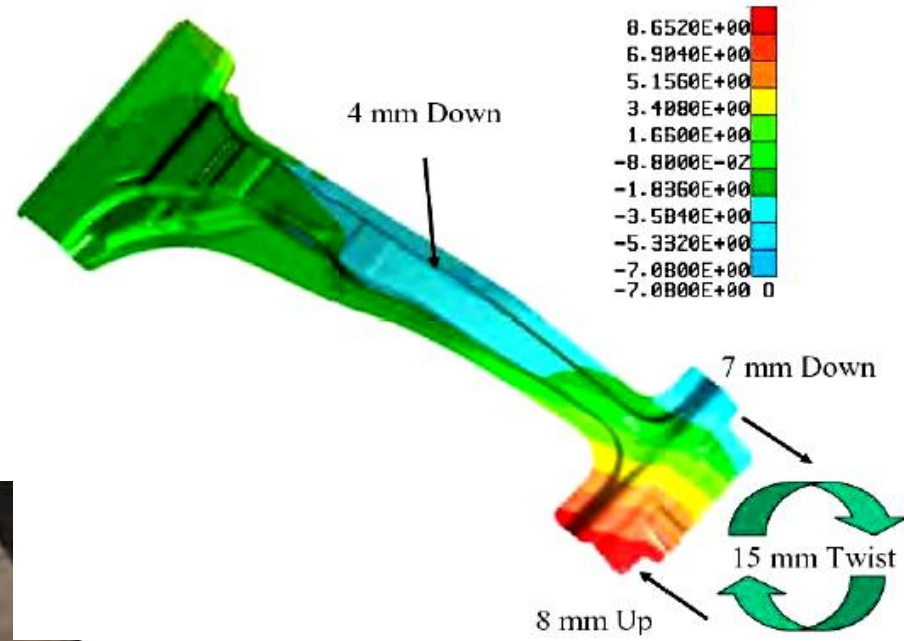
Figure 5: Experimental and numerical FLC for the DP 350/600 steel.

THE INFLUENCE OF ELASTIC MODULUS VARIATION EFFECT ON PREDICTION OF SPRINGBACK FOR AHSS



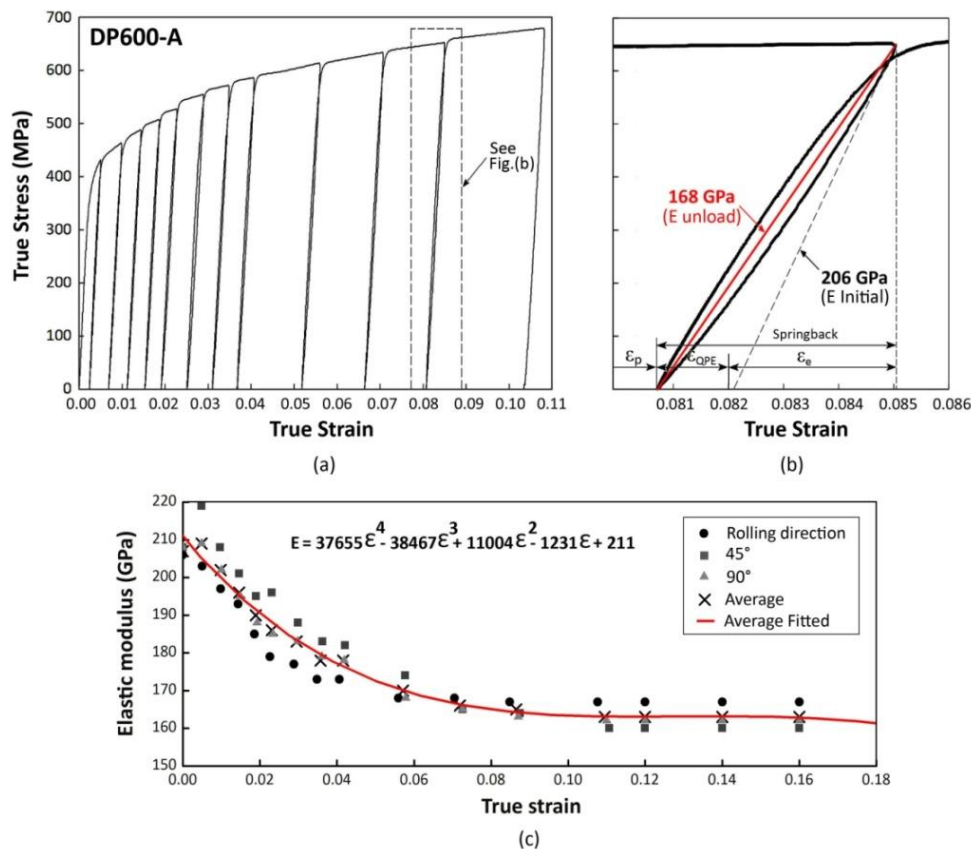
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Industrial challenge



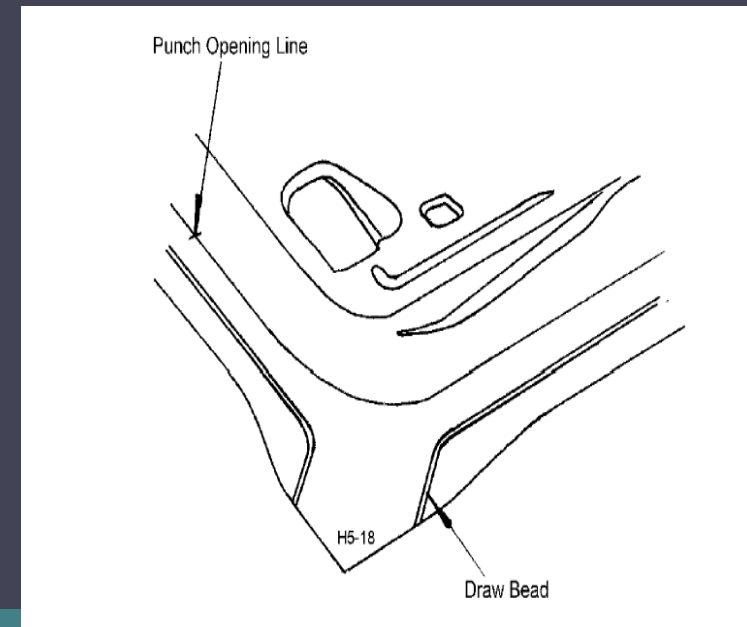
Improved springback prediction

Study of material elastic behavior for better characterization in the simulation software



Unloading-loading cycles obtained from the uniaxial tensile tests: (a) DP600-A, (b) detail showing the behavior of the unloading elastic modulus and (c) measured elastic modulus at various strains.

THE INFLUENCE OF BAUSCHINGER EFFECT ON PREDICTION OF SPRINGBACK FOR AHSS



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THE INFLUENCE OF BAUSCHINGER EFFECT ON PREDICTION OF SPRINGBACK FOR AHSS

'Draw Bead'

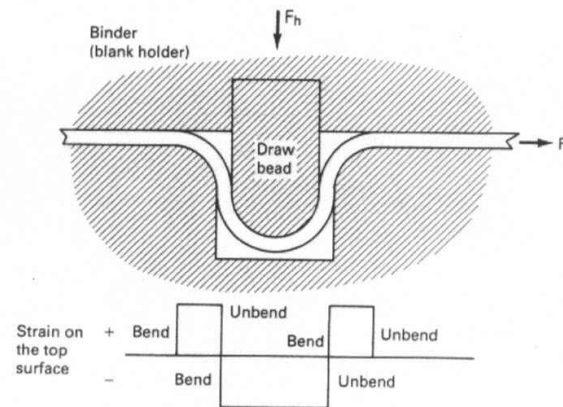
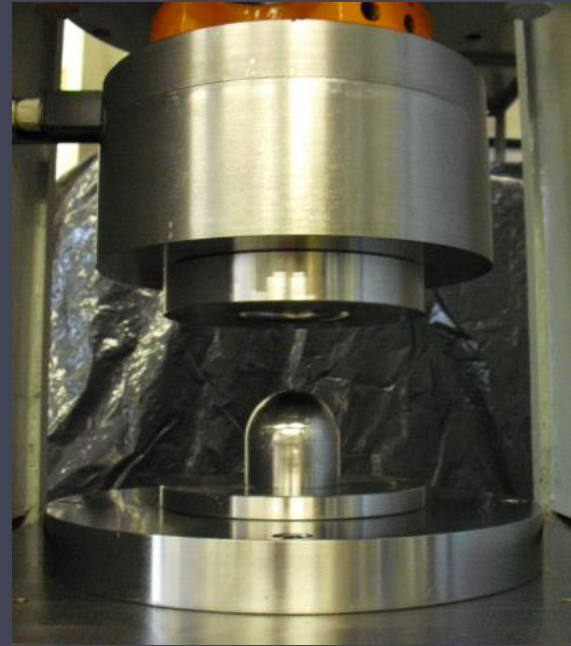


Figure 16-3 The bending and unbending as a strip is drawn over a draw bead. The strains on the bottom surface are indicated schematically.

- Determining a new method for obtaining the Bauschinger effect curves for AHSS.

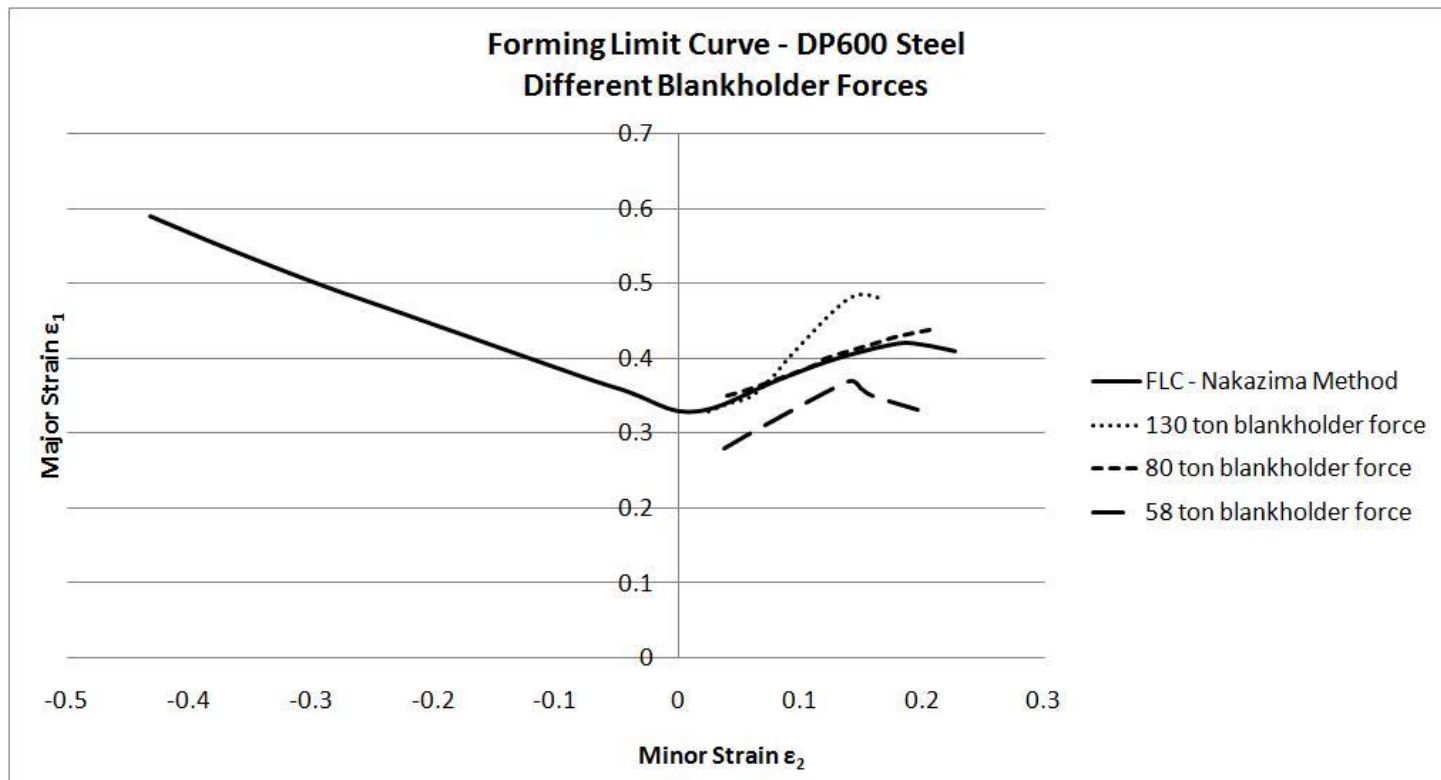
FORMING ANALYSES TO DIFFERENT BLANKHOLDER FORCES



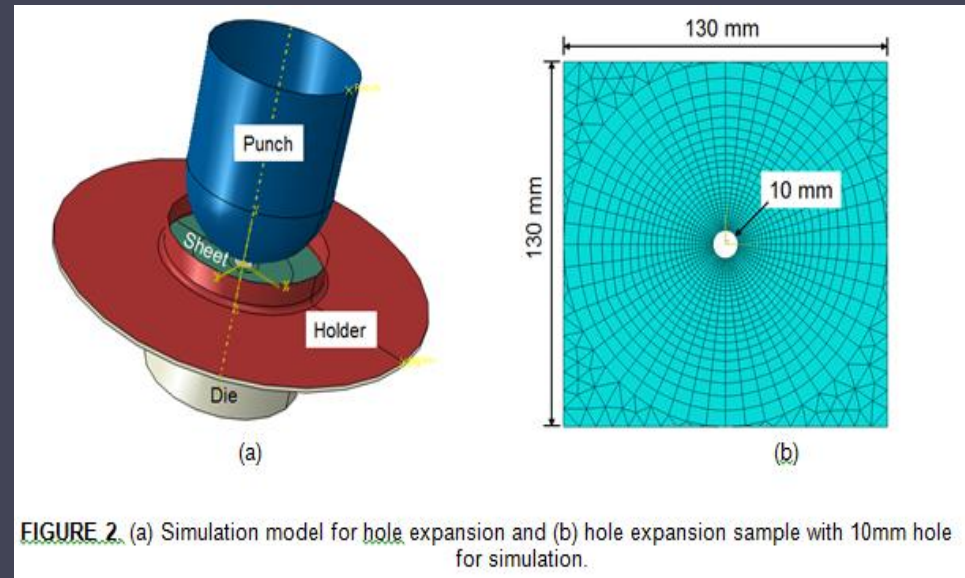
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FORMING ANALYSES OF AHSS TO DIFFERENT BLANKHOLDER FORCES

To evaluate the influence of blankholder force in the formability of "Dual Phase" DP600 steel.



EXPERIMENTAL AND NUMERICAL ANALYSIS ON STRAIN DEVELOPMENT DURING HOLE EXPANSION OF AHSS



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- ✓ Characterize material mechanical properties, sheet formability and crack propagation for AHSS.

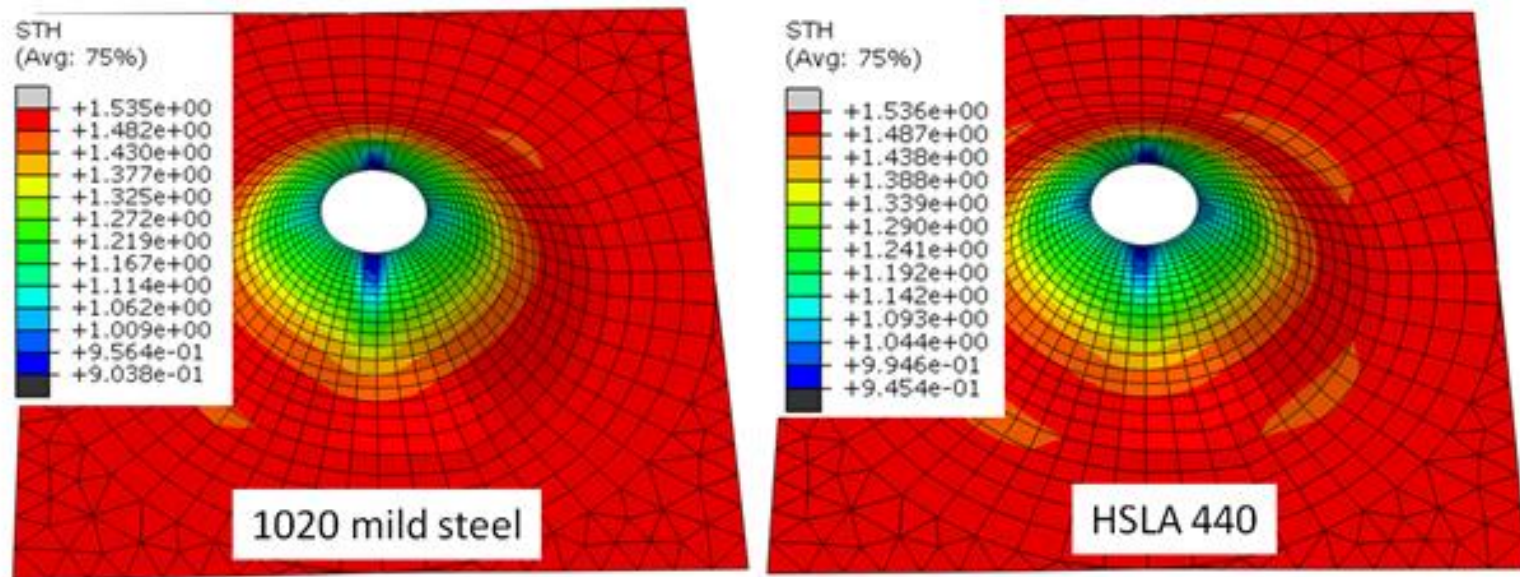
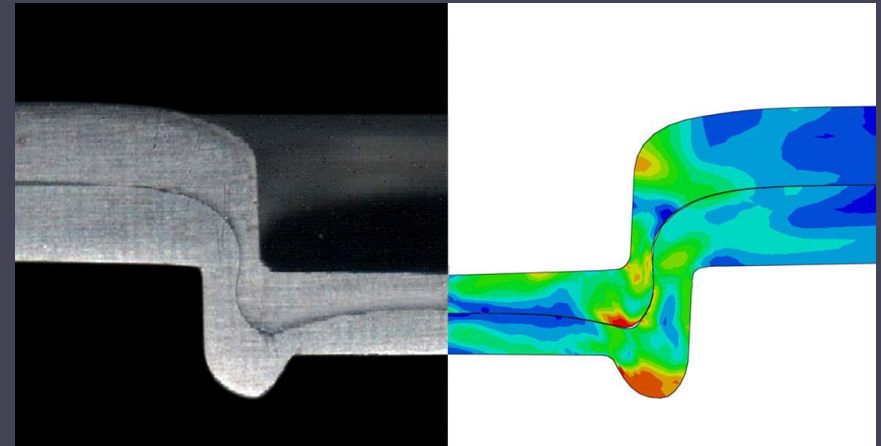
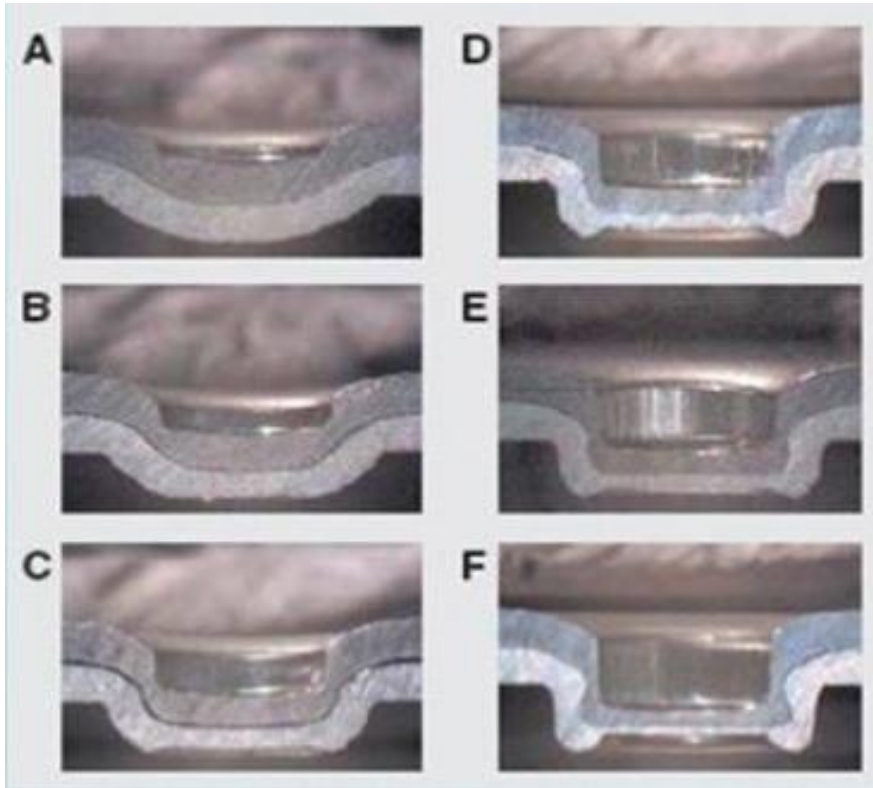


Figure 3. 1020 mild steel and HSLA 440 deformed simulated blank

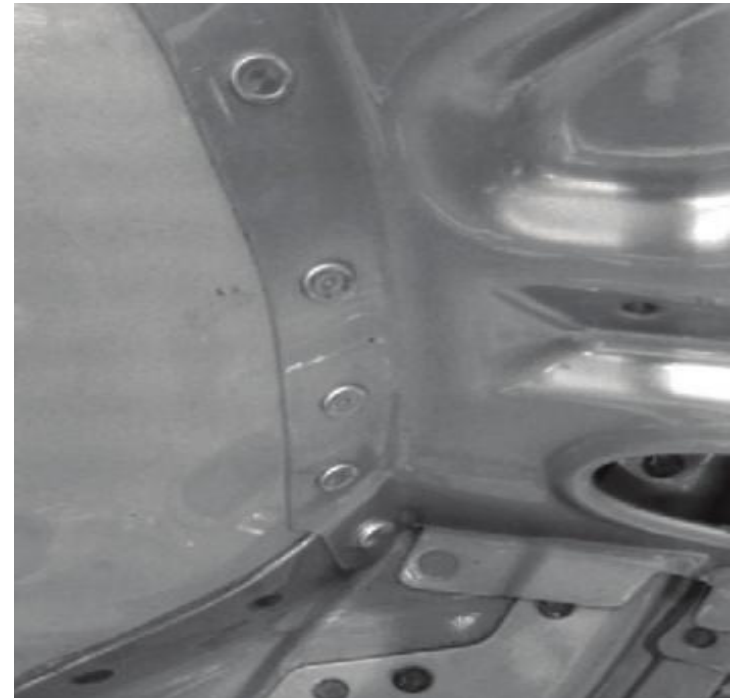
THE UNION OF SHEET METAL BY CLINCHING



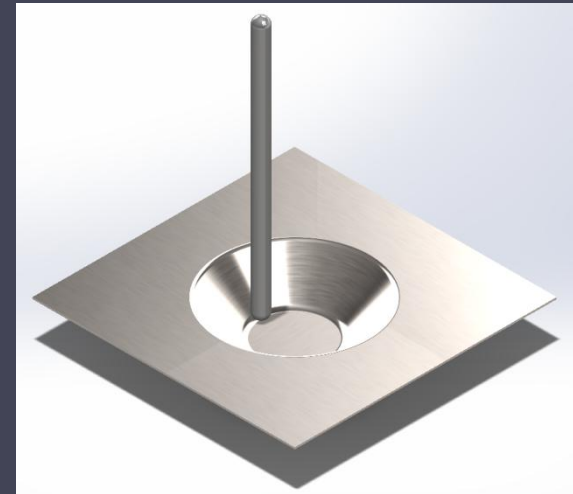
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Industrial challenge

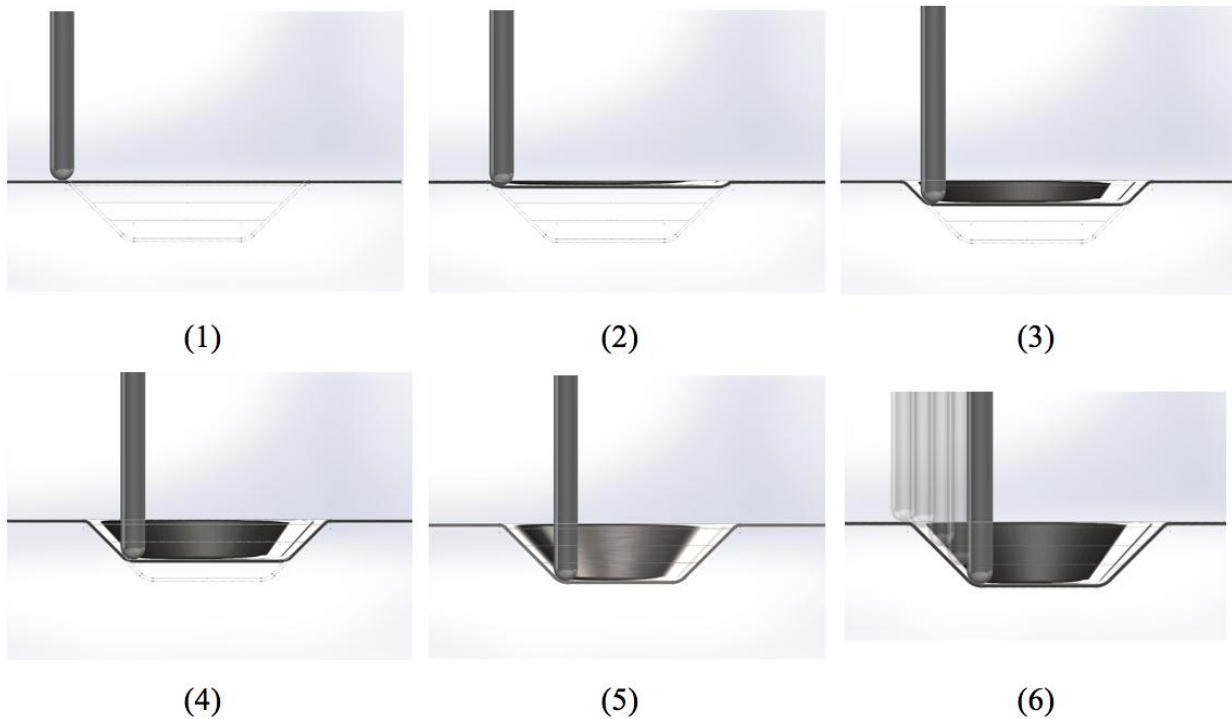


Incremental Sheet Forming



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- CNC Machines (CAD/CAM)



- Formability better than Deep Drawing
- Small Batch
- No Die Required
- Reduced Time and Cost
- Customized Products

Incremental Forming

Punch Wear

Stretching capabilities

Deep Drawing capabilities



Force

FLC's

Simulation



THANK YOU

For further informations feel free to ask for scientific papers related to the subjects

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