

# Modelling of HSS endplate connections at Ambient and Elevated Temperatures

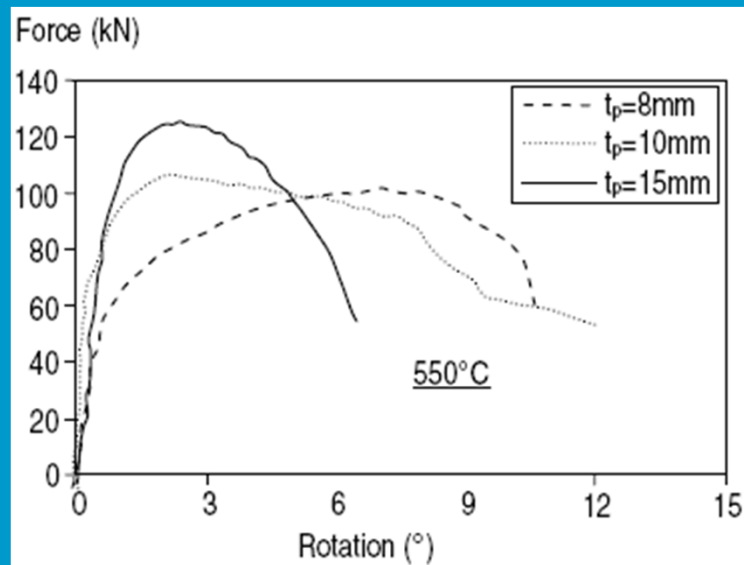
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Frans Bijlaard  
Henk Kolstein  
Leen Twilt

PhD candidate  
Professor  
Associate Professor  
IR

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# Introduction – Research Idea



Endplate thickness effect  
from Ian Burgess and Yu  
(University of Sheffield)

Idea:

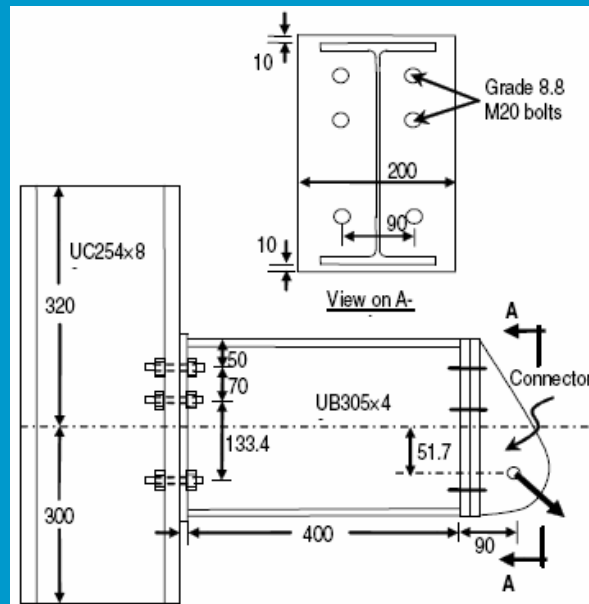
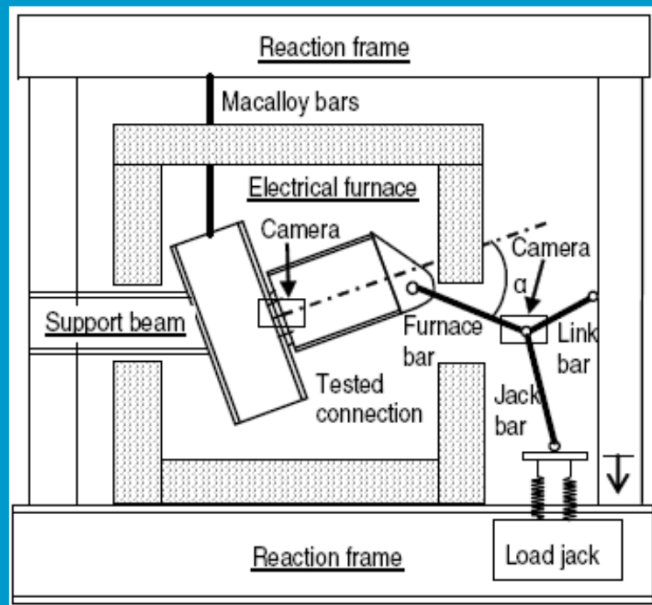
Using HSS, the needed endplate thickness may be less.

thinner HSS endplate  $\longrightarrow$  more ductile

# Experimental Tests

## Mild steel endplate connections at elevated temperatures

By Hongxia Yu and Ian Burgess (University of Sheffield)



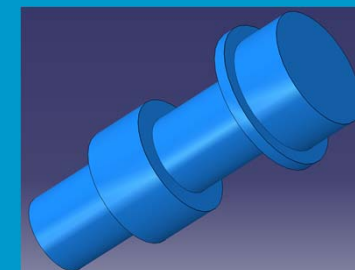
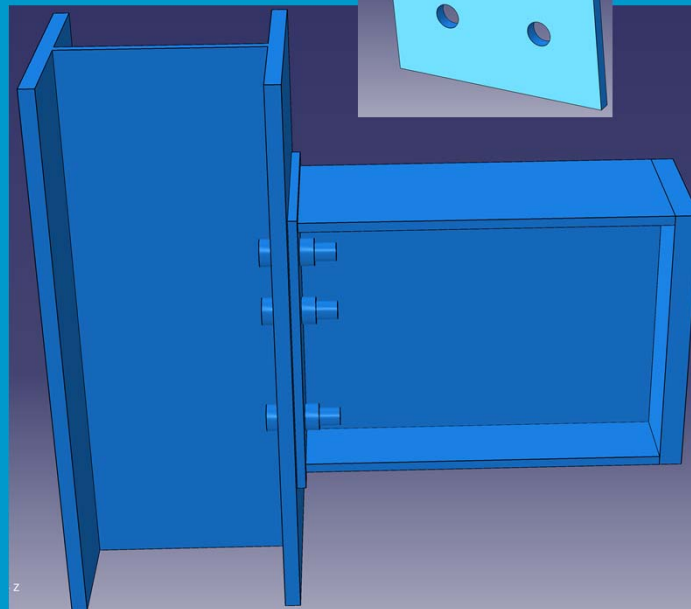
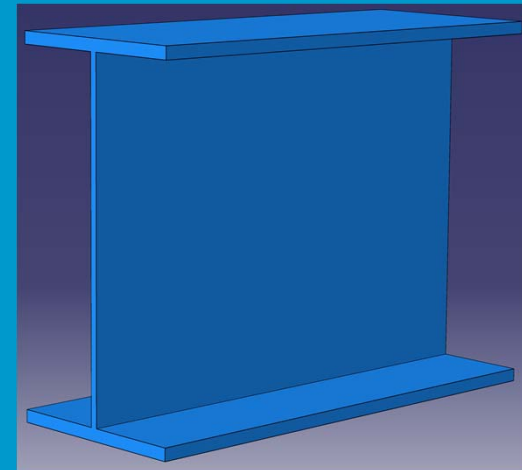
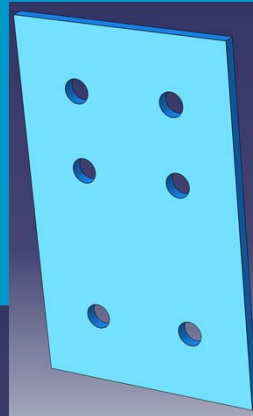
Column:  
UC254 × 89 made of  
S355

Beam:  
UB305 × 165 × 40  
made of S275

Endplate:  
made of S275

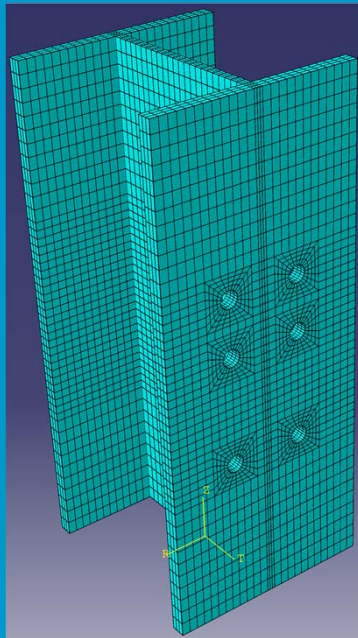
# Finite Element Analysis

## Geometric details

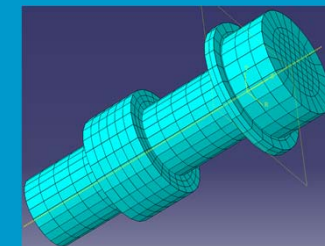
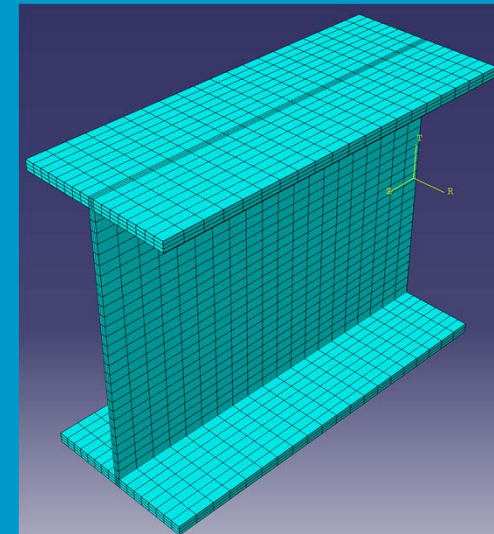
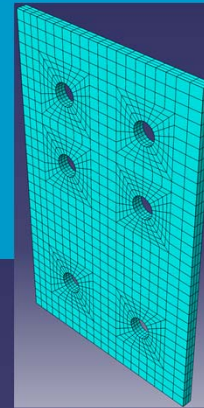
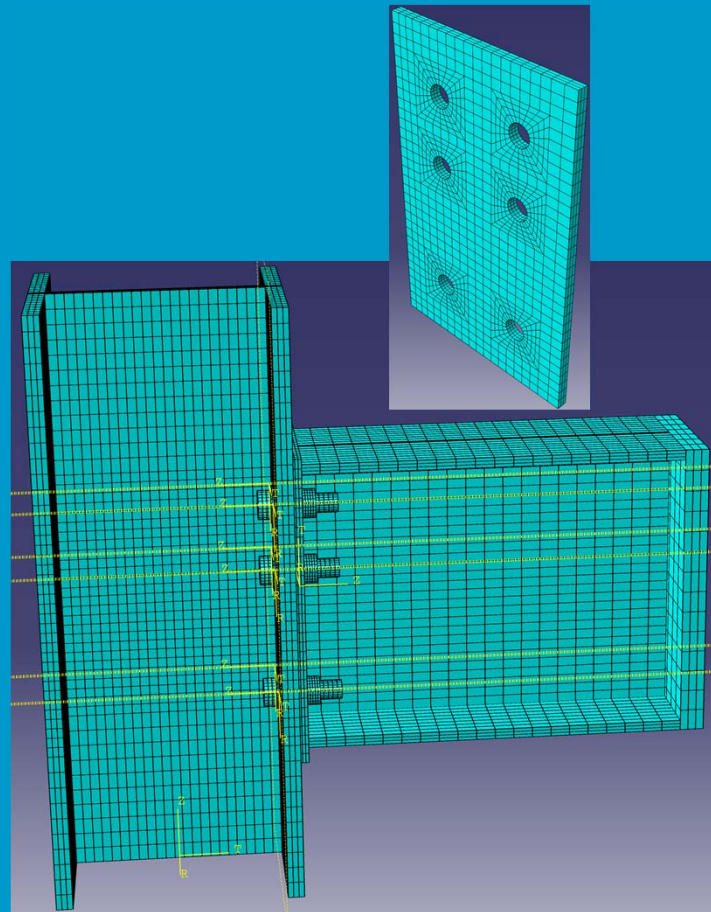


# Finite Element Analysis

## Mesh generation

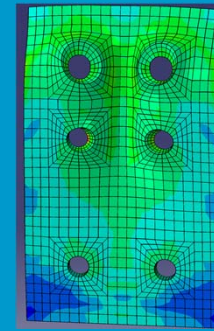


Element type:  
C3D8I

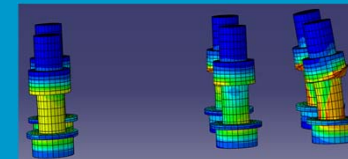
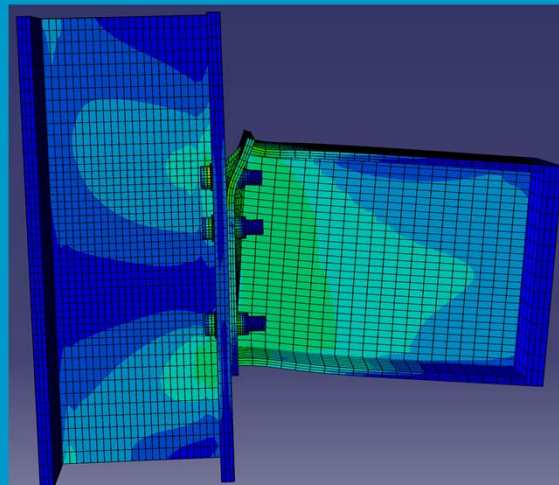
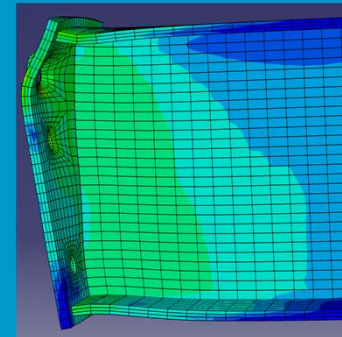


# Validation against Test Results

Comparison of failure modes - ambient temperature



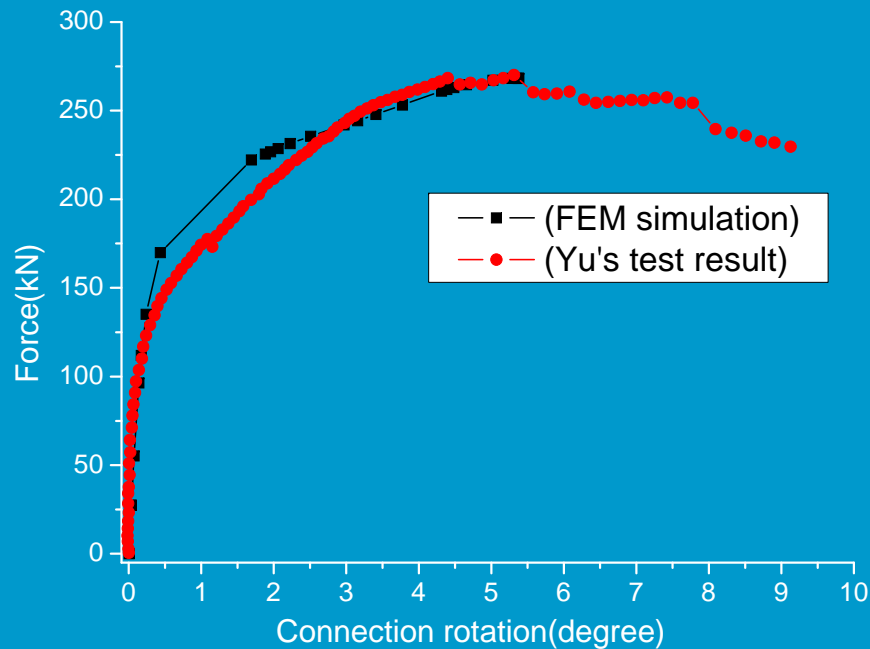
10E55RS275



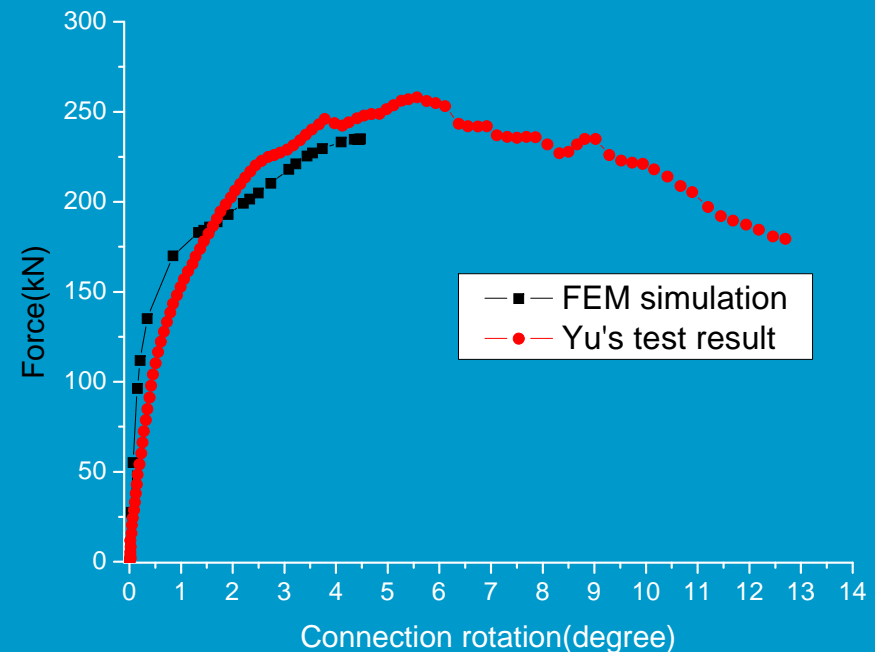
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# Validation against Test Results at Ambient Temperature



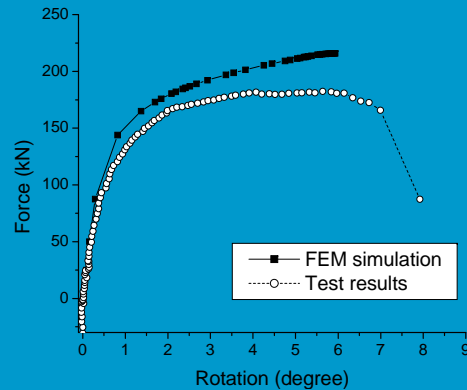
a) 10E55RS275



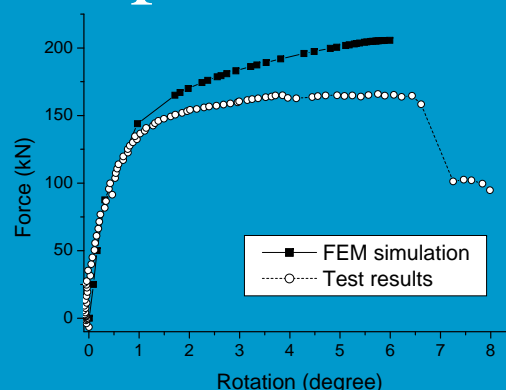
b) 8E35RS275

Force-rotation curves of connections at ambient temperature

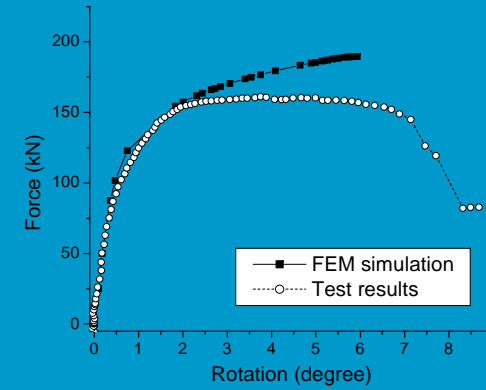
# Validation against Test Results at Elevated Temperatures



a) 35° initial load angle

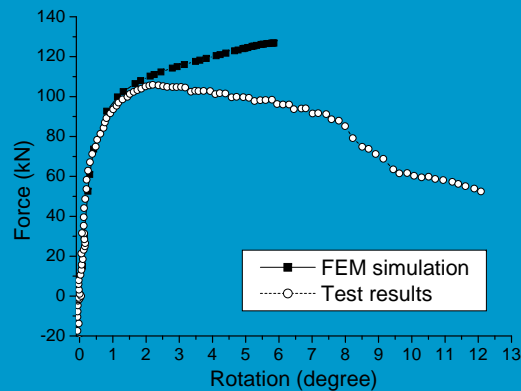


b) 45° initial load angle

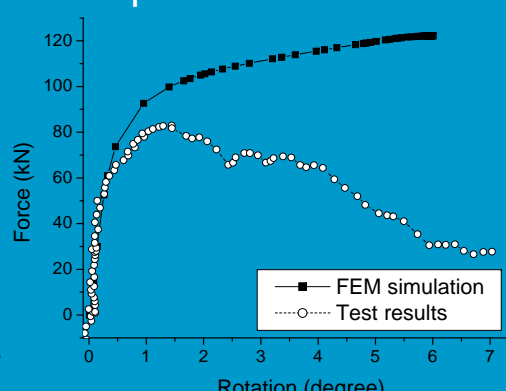


c) 55° initial load angle

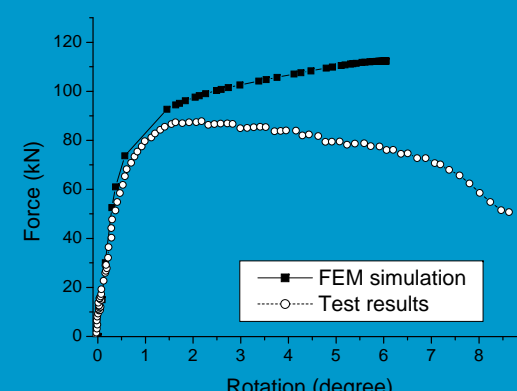
## Force-rotation comparisons of 10mmS275 at 450°C



a) 35° initial load angle



b) 45° initial load angle



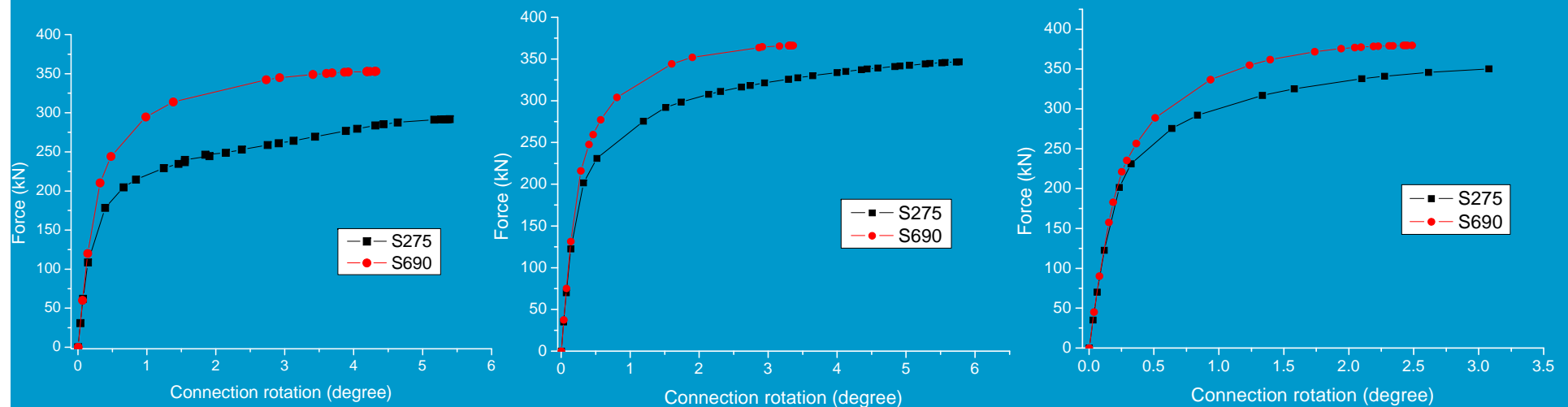
c) 55° initial load angle

## Force-rotation comparisons of 10mmS275 at 550°C



# Numerical Prediction of HSS Endplate Connections

same thickness of endplate *at ambient temperature*



(a) 10mm thickness endplate

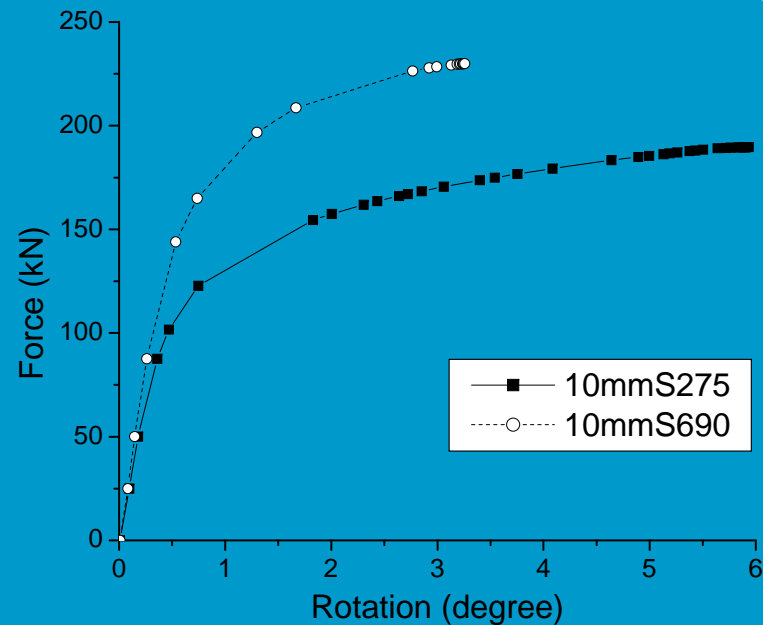
(b) 12mm thickness endplate

(c) 15mm thickness endplate

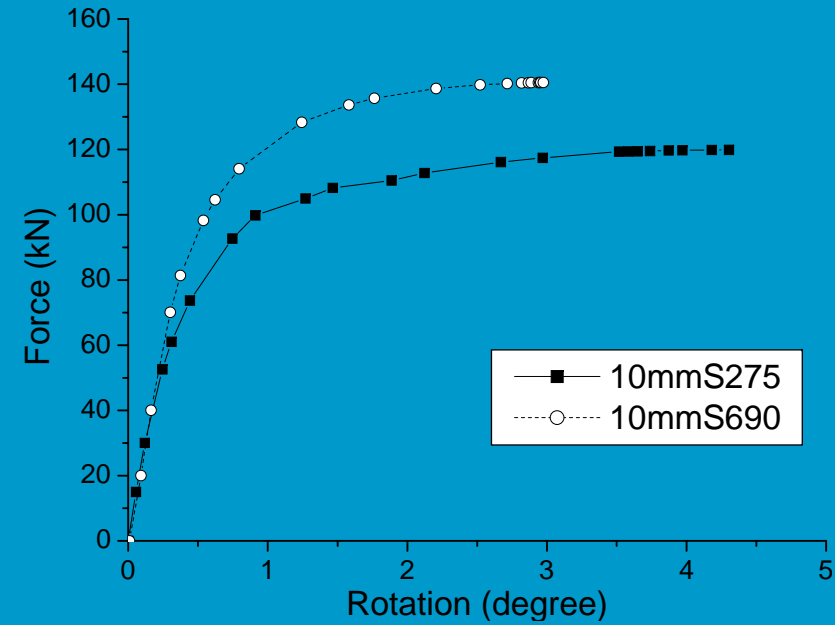
Force-rotation comparisons at ambient temperature

# Numerical Prediction of HSS Endplate Connections

same thickness of endplate *at elevated temperatures*



(a) 450° C

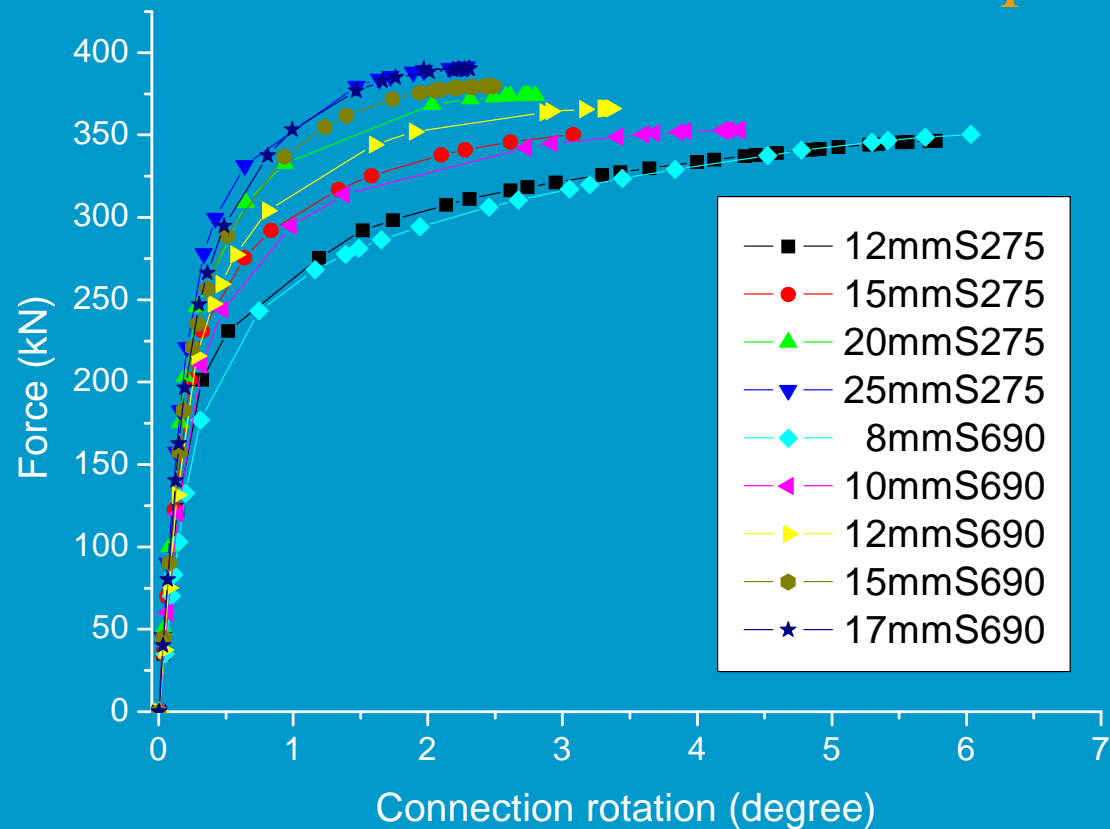


(b) 550° C

Force-rotation comparisons at elevated temperatures

# Parametric Study of HSS Endplate Connections

Thickness effect *at ambient temperature*



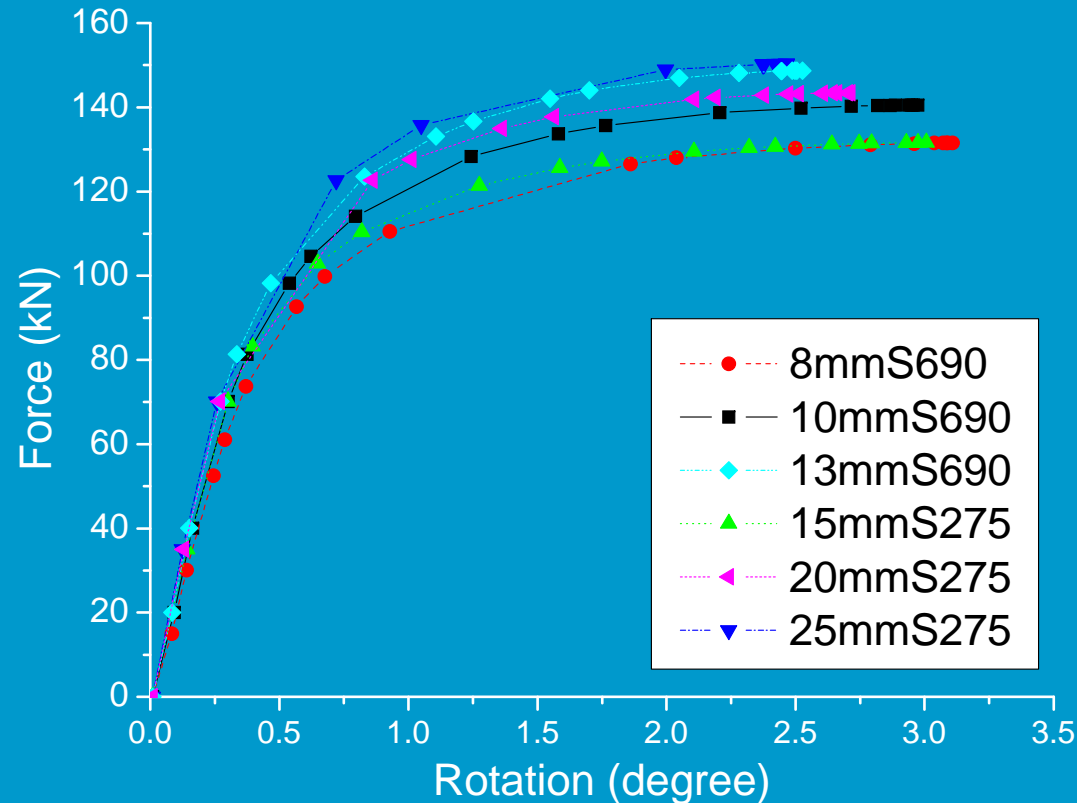
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# Parametric Study of HSS Endplate Connections

Thickness effect *at elevated temperatures*

e.g. at 550° C



Thank you very much  
for your attention.

Questions or comments?