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NTEC
Nottingham Transportation Engineering Centre

SURFACE STRAINS CAUSED BY UNIFORM AND NON-UNIFORM CONTACT PRESSURES

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TRAINING in EUROPEAN ASSET MANAGEMENT
TEAM

The University of Nottingham
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My Background

- I am from Co. Louth in the Republic of Ireland.
- My primary degree is a BA/BAI in Civil, Structural and Environmental Engineering from Trinity College, University of Dublin.
- I have been based at the University of Nottingham for 2 years now.

Project Background

- **This Project is part of a Marie Curie Initial Training Network (ITN) called Training in European Asset Management TEAM**
- **The individual project this paper is connected to is based in the University of Nottingham at NTEC**
- **The overall goal is to assess the impact that non-uniform contact pressures have on surface distress.**

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MARIE CURIE ACTIONS

Research Background

- The traditional representation of a tyre is a circular contact patch with a constant vertical load.
- The materials are represented by a multi-layer linear elastic system.
- The methods usually have two modes of failure in the pavement, fatigue cracking at the base of the asphalt package and rutting at the top of the subgrade.

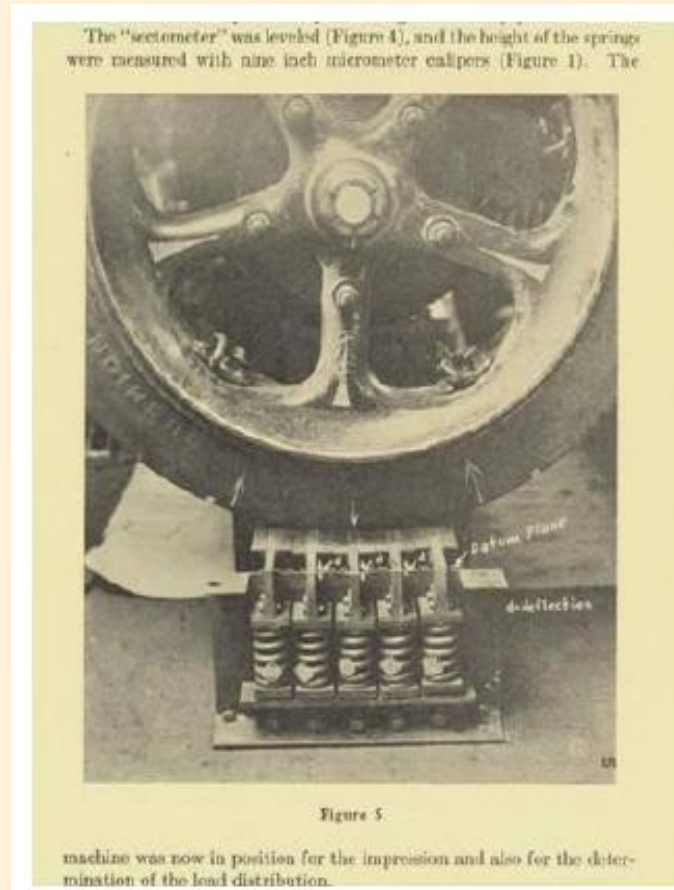

The "sectometer" was leveled (Figure 4), and the height of the springs were measured with nine inch micrometer calipers (Figure 1). The

Figure 5

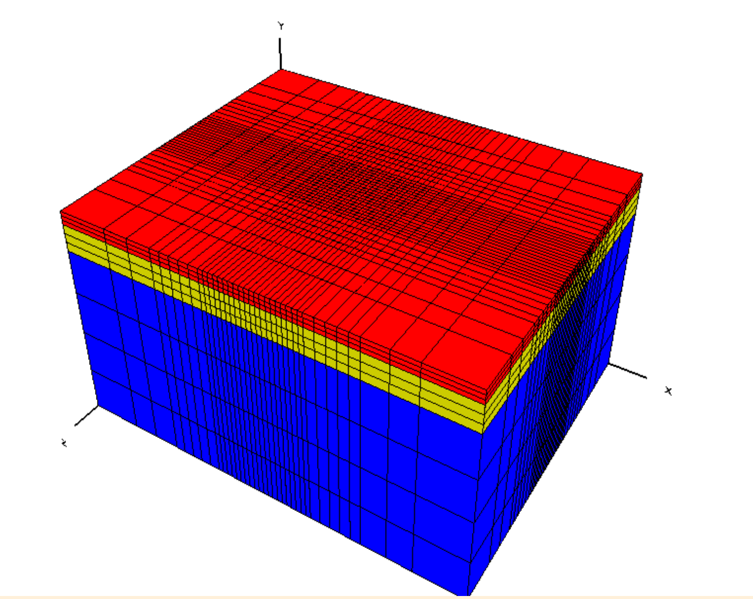
machine was now in position for the impression and also for the determination of the load distribution.

Specific Goals of this Paper

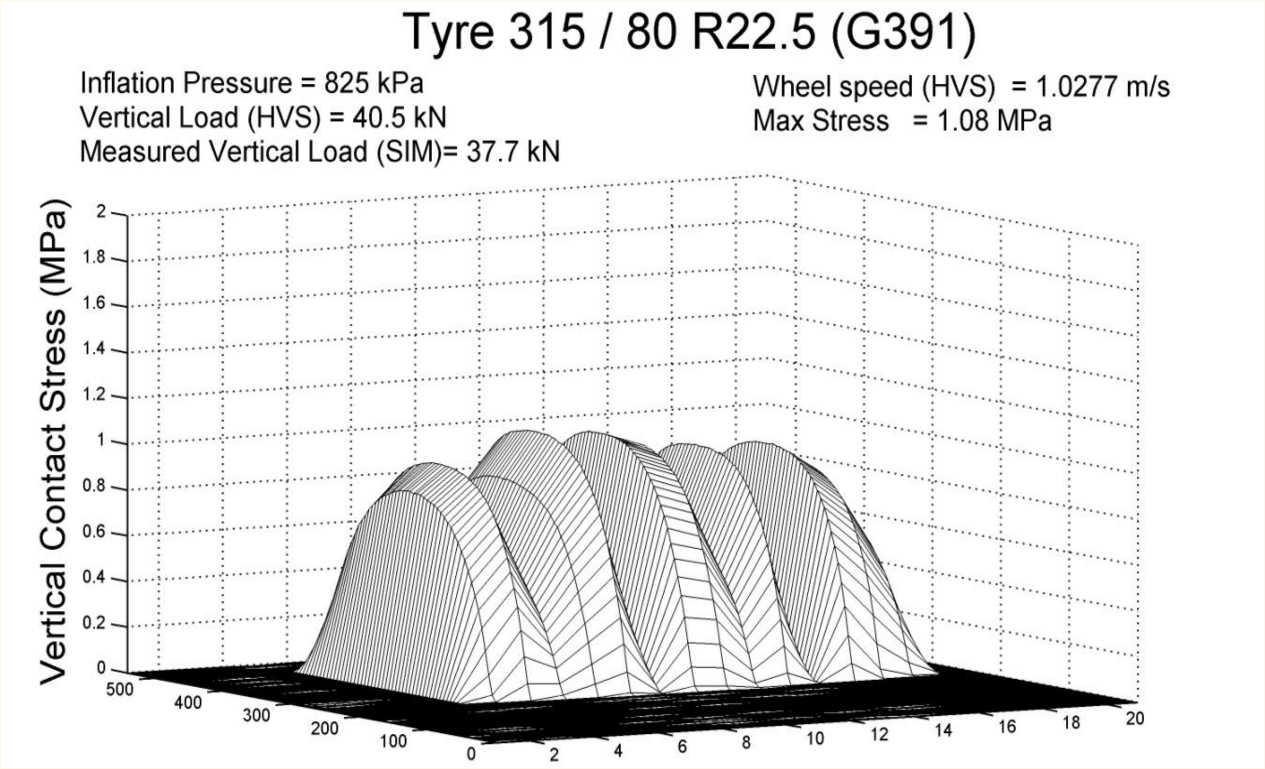
- **To establish the variation in the strain induced on the surface and the near surface by non-uniform contact pressure in comparison with uniform contact pressure.**
- **To illustrate how the effects of the non-uniform contact pressure reduce rapidly with depth and/or distance from the contact area.**
- **To highlighting the shear strains that the non-uniform contact pressure induce under the contact area.**

Set-up and Process of Research

- **The mesh was set-up as shown on the right and was validated against BISAR.**
- **The material model was linear elastic for all layers with full bonding between layers.**
- **The Materials all had a possion ratio of 0.35. The subgrade Young's modulus was 100 MPa, Subbase 700 Mpa, 4500 for the ashphalt layer.**

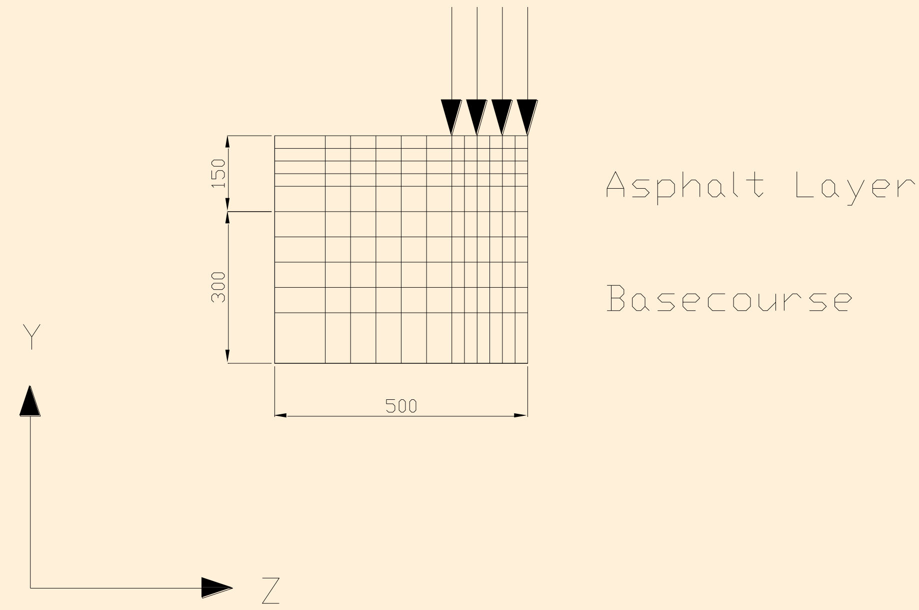


Original Vertical Stress

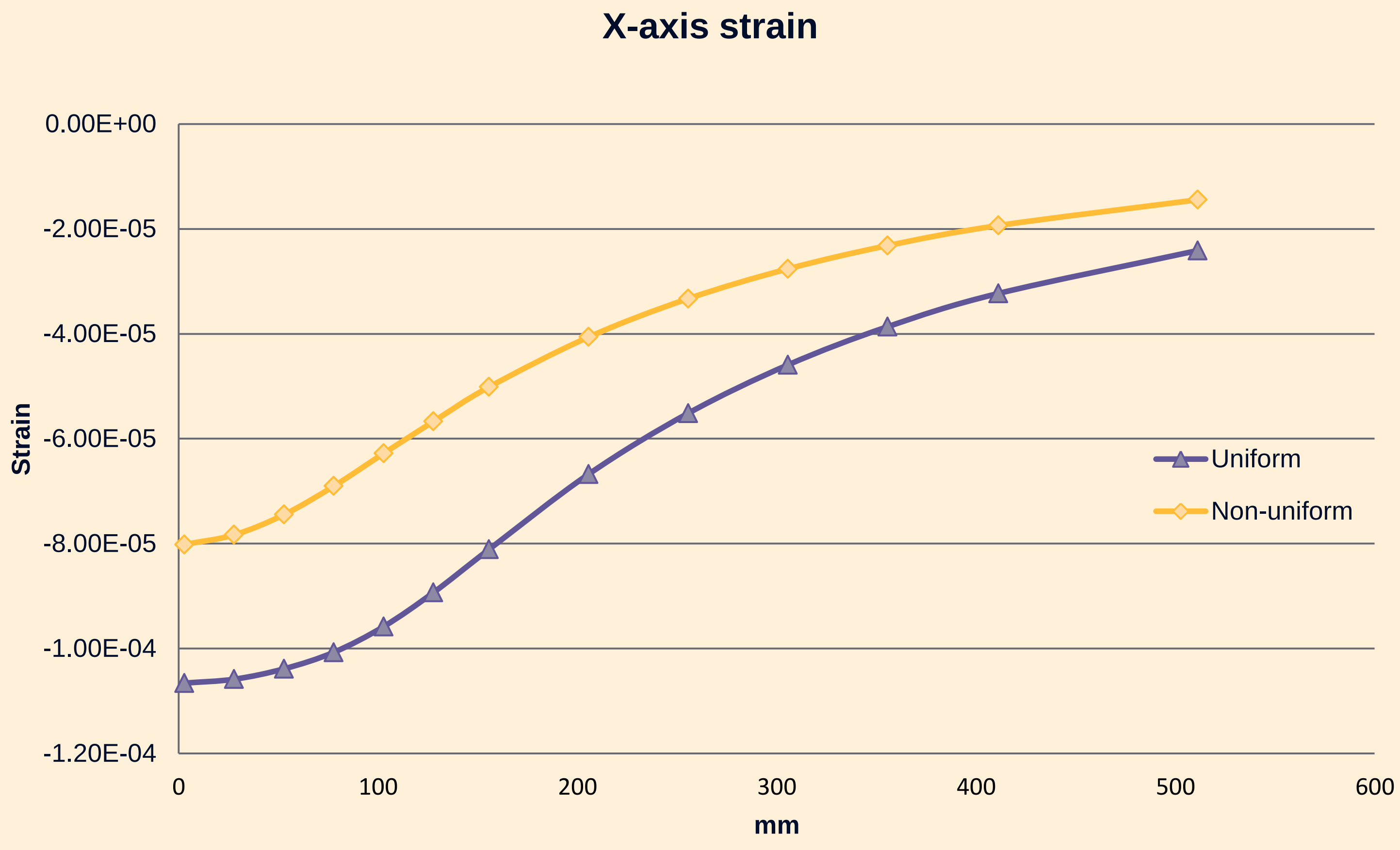


Set-up and Process of Research

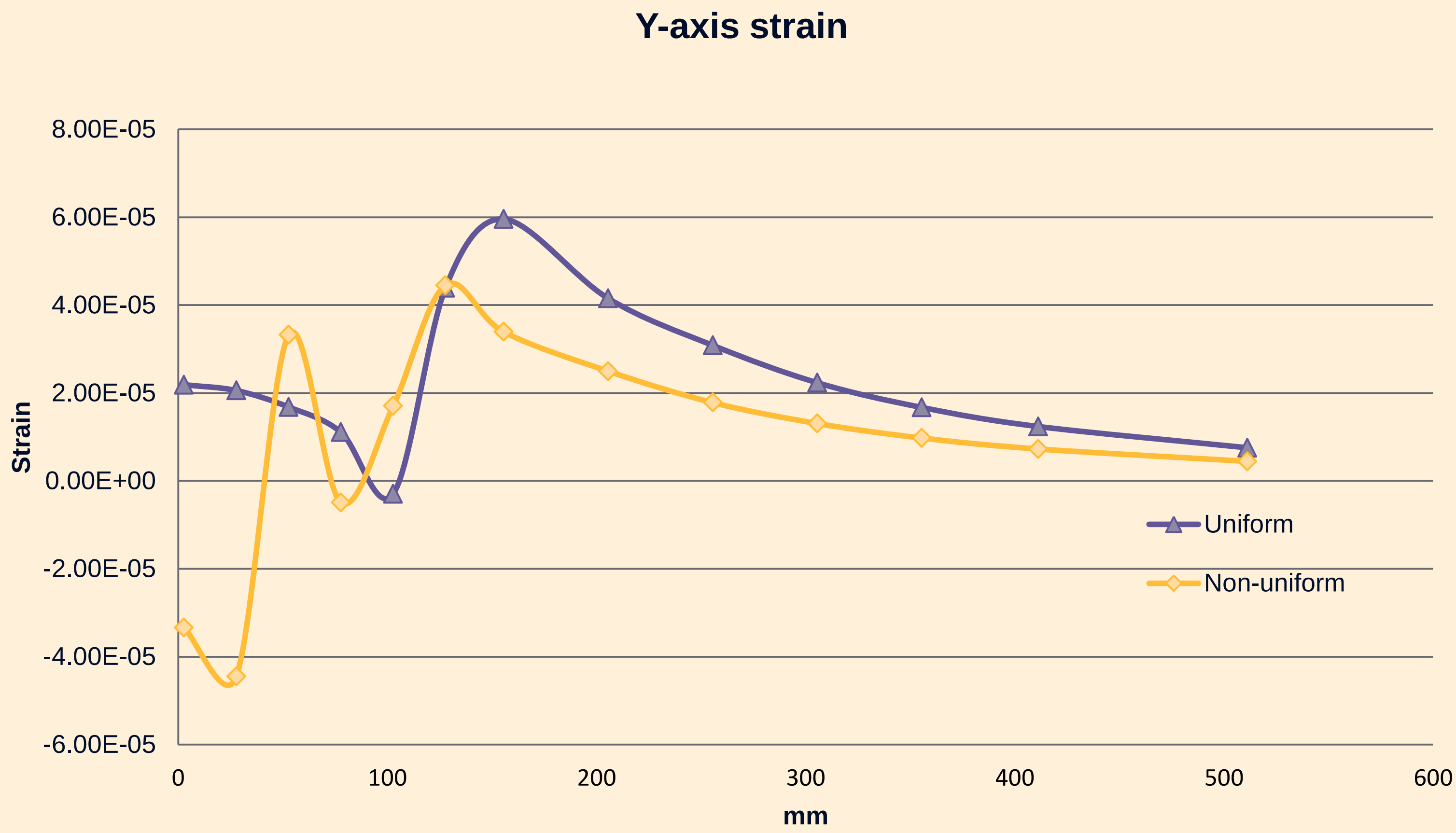
398kPa	430kPa	441kPa
737kPa	890kPa	772kPa
355kPa	362kPa	355kPa



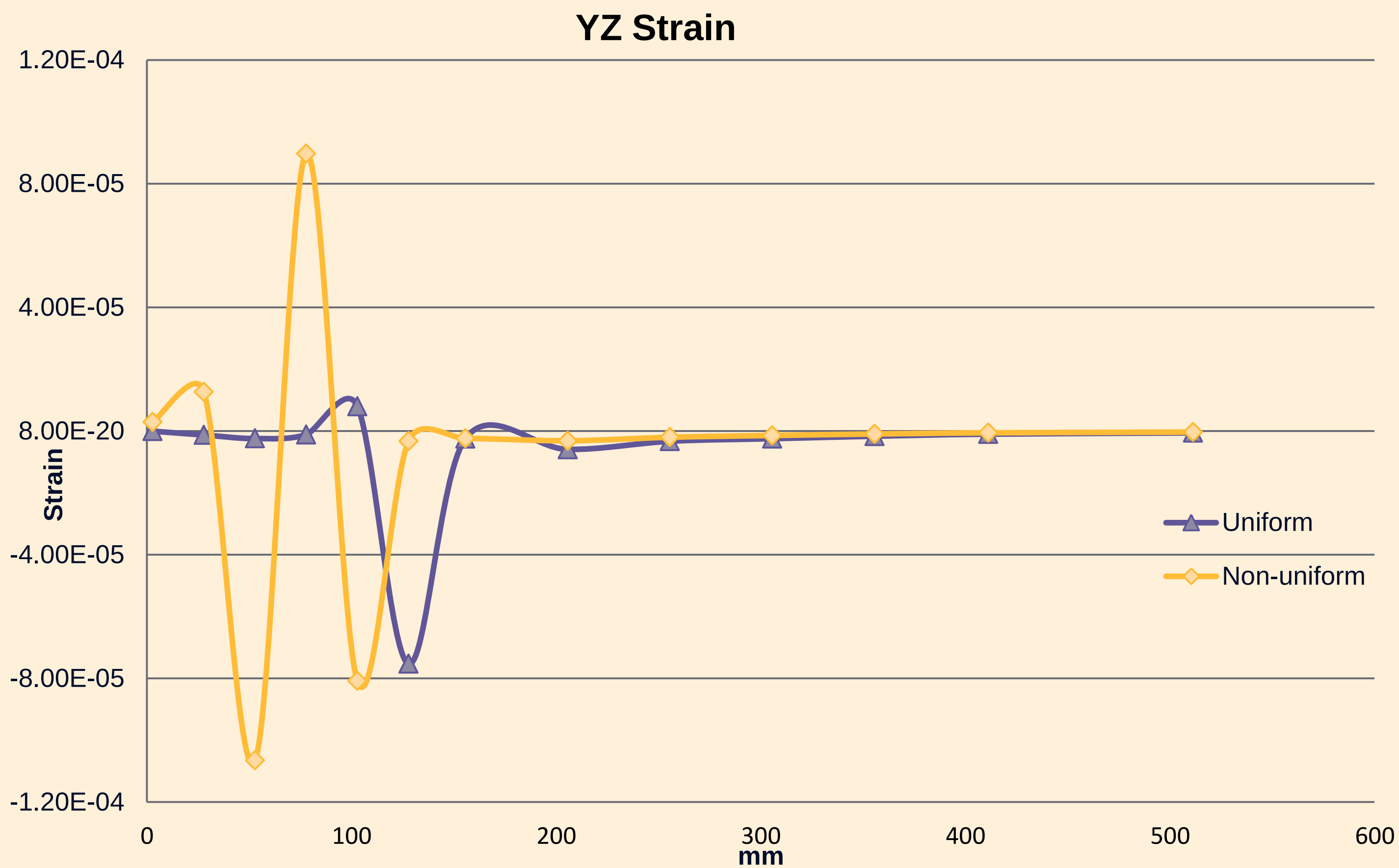
Results : Strain at 2.5mm



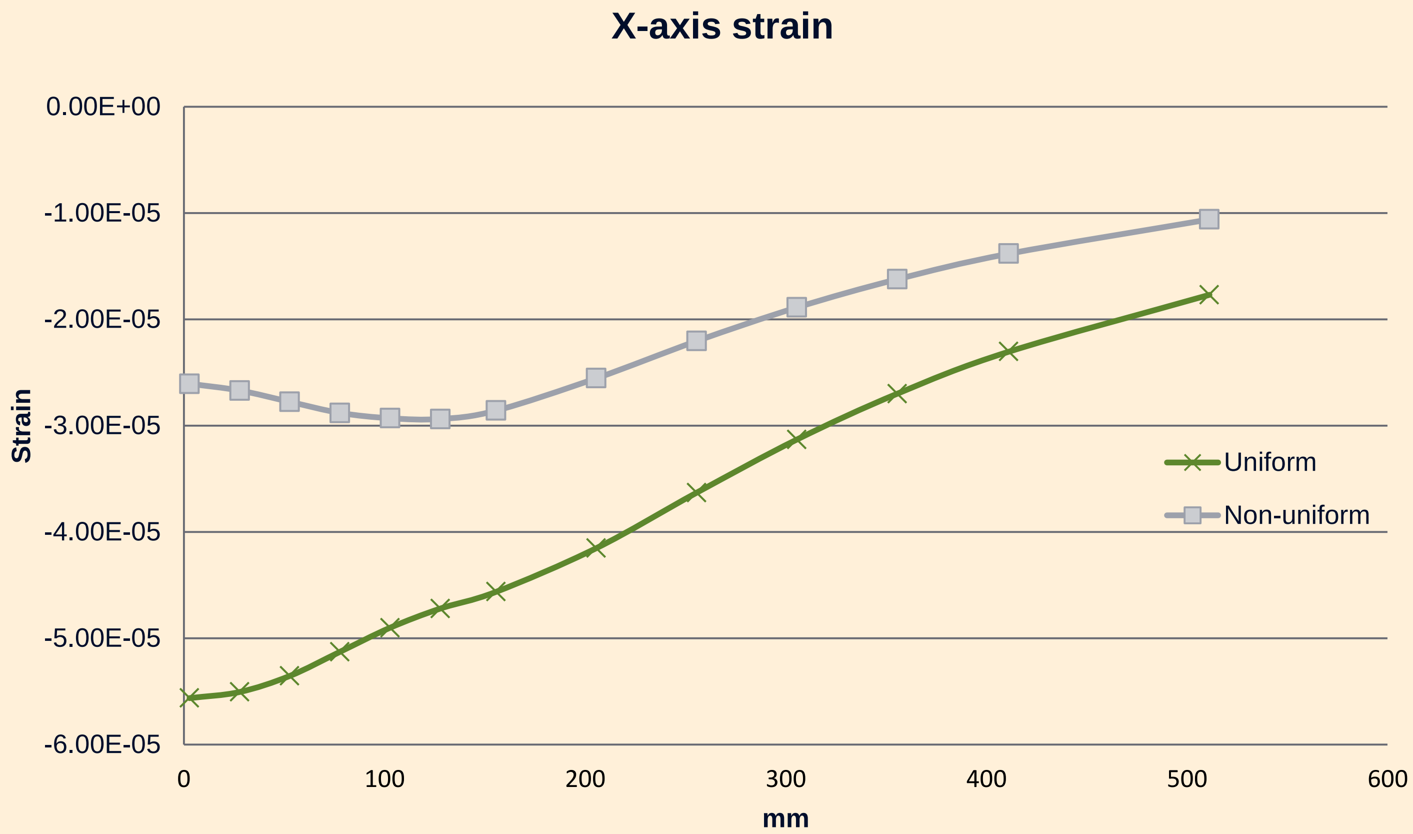
Results : Strain at 2.5mm



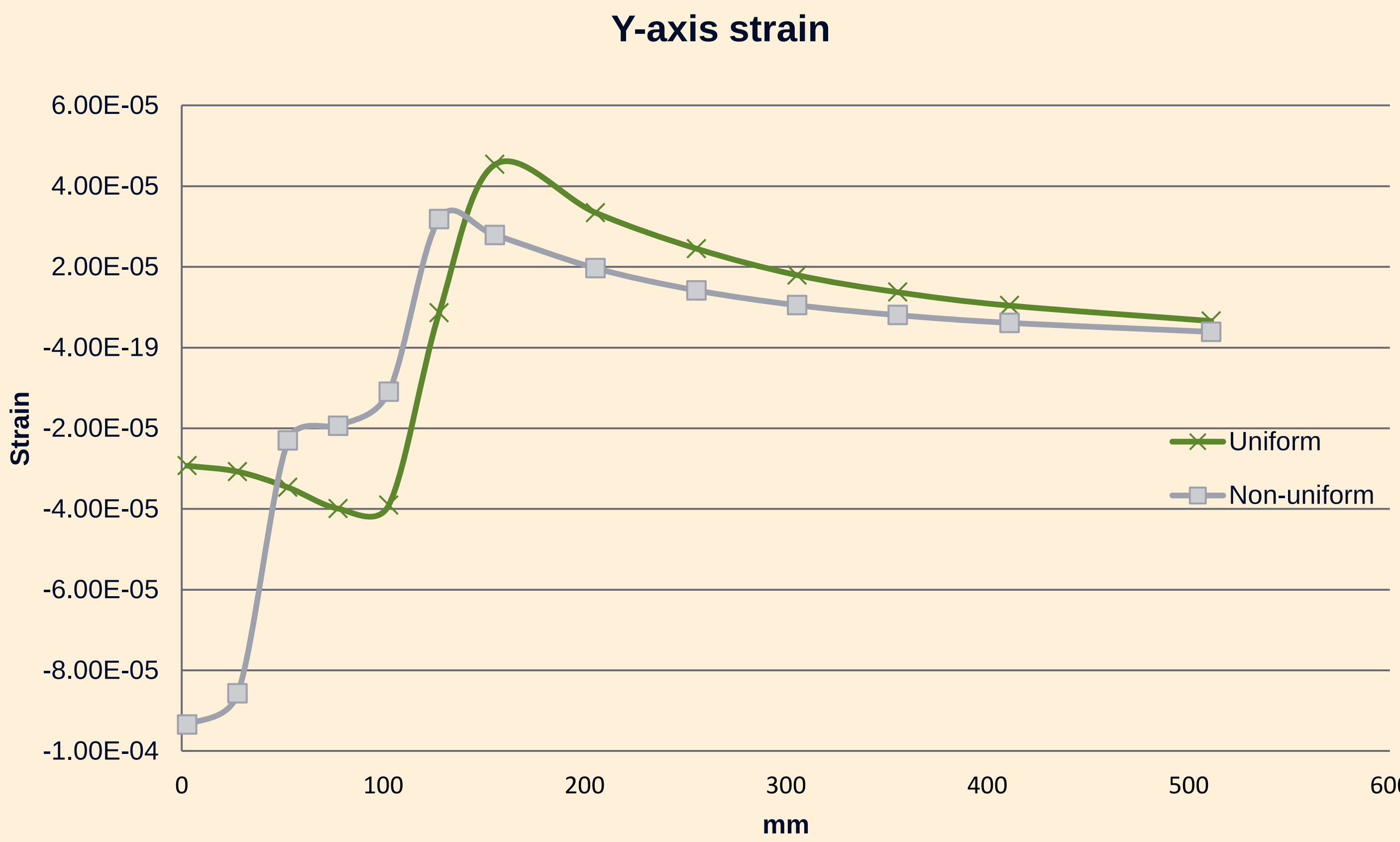
Results : Strain at 2.5mm



Results : Strain at 27.5mm



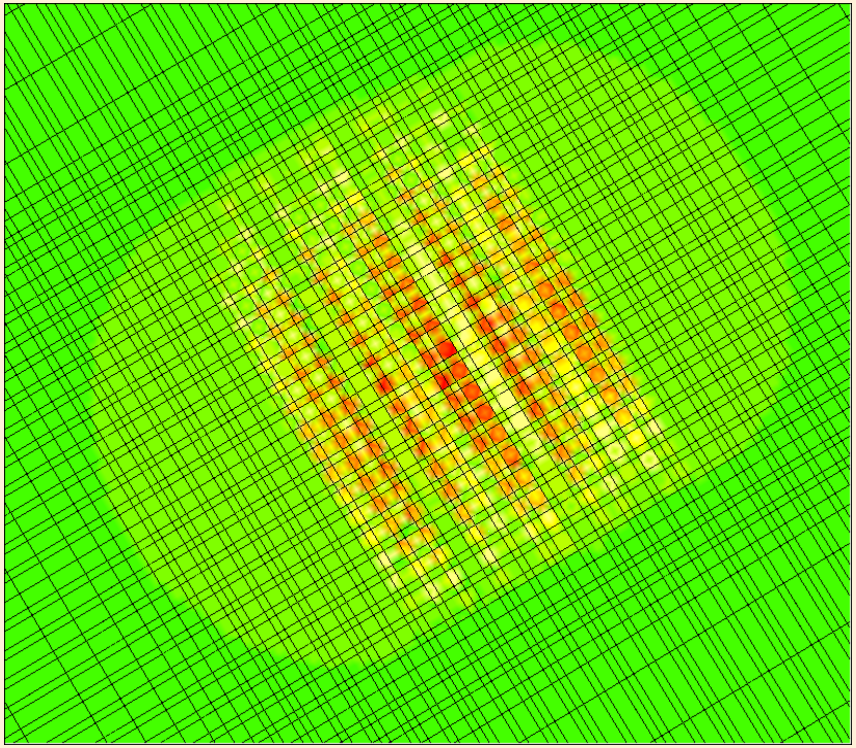
Results : Strain at 27.5mm

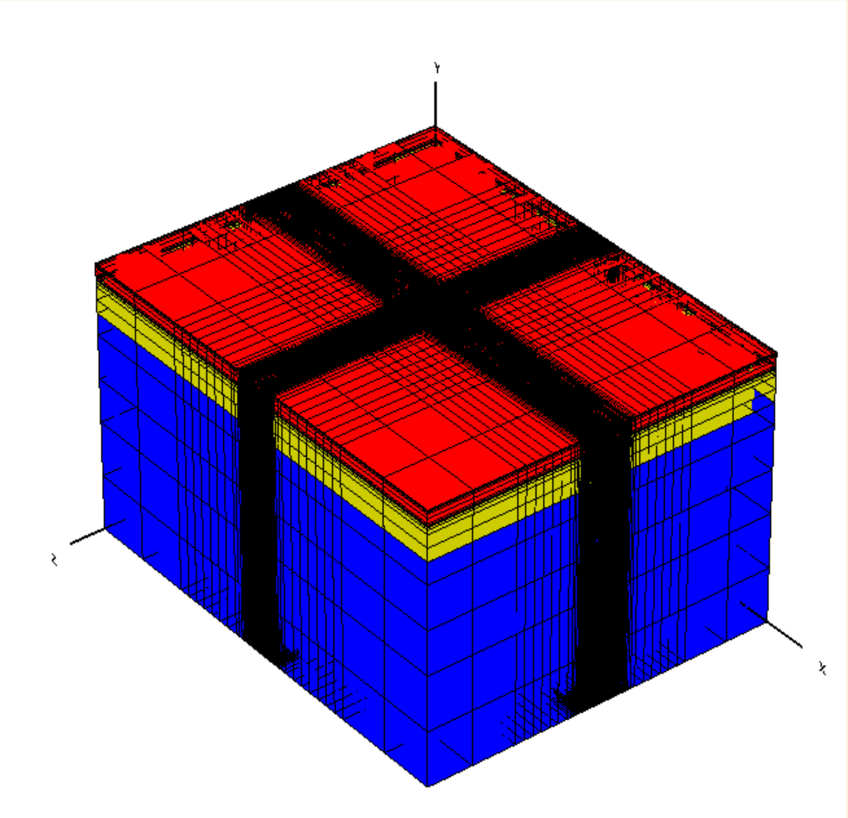


Conclusions

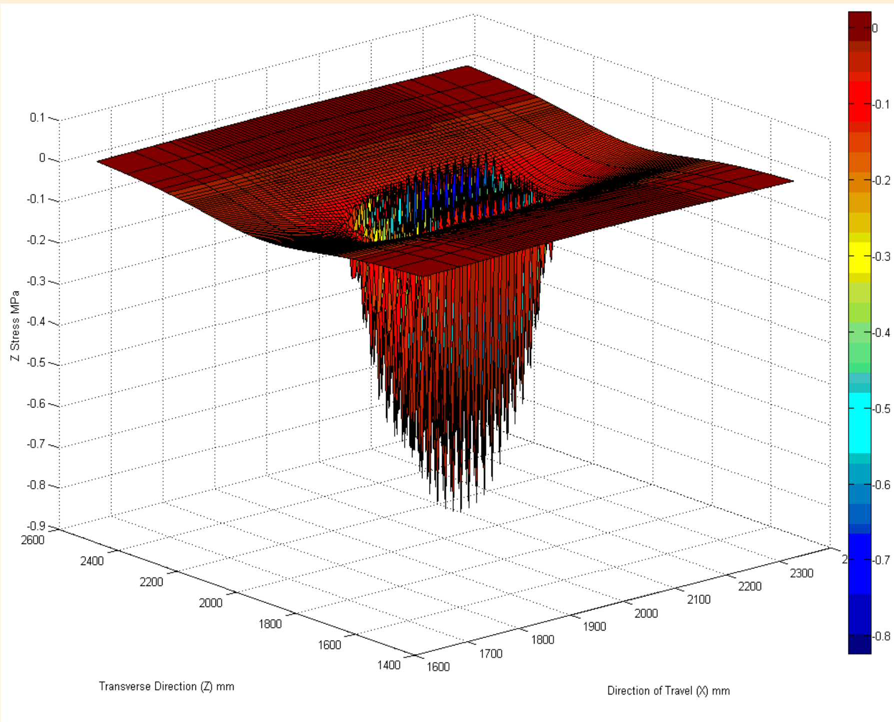
- **The peak strain levels are recorded for the non-uniform contact pressure for the principal axes for both the 2.5mm depth and the 27.5mm depth.**
- **The non-uniform contact pressure creates significant non-uniformity of strain under the contact area for the principal axis at both depths.**
- **Non-uniform contact pressure creates a largely varying shearing strain under the contact area. This is completely different than the uniform contact pressure case and not accounted for in current design procedure. The maximum of this strain is comparable in magnitude to the maximum principal axes strain.**
- **A highly complex strain state is created under the contact area of the non-uniform contact case in comparison to uniform contact pressure.**

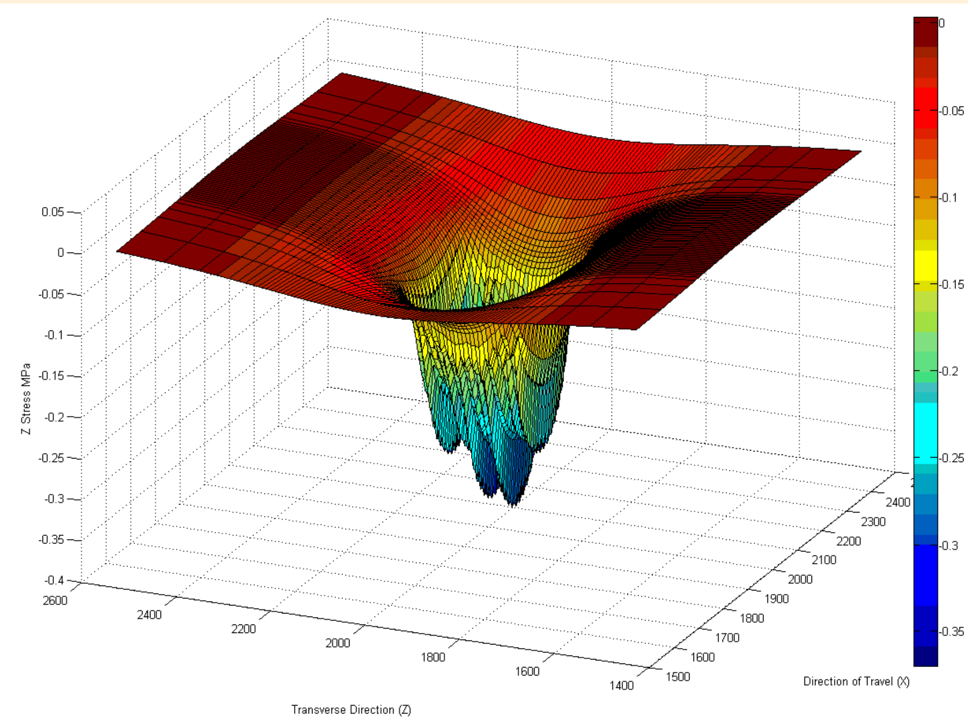
Current Research



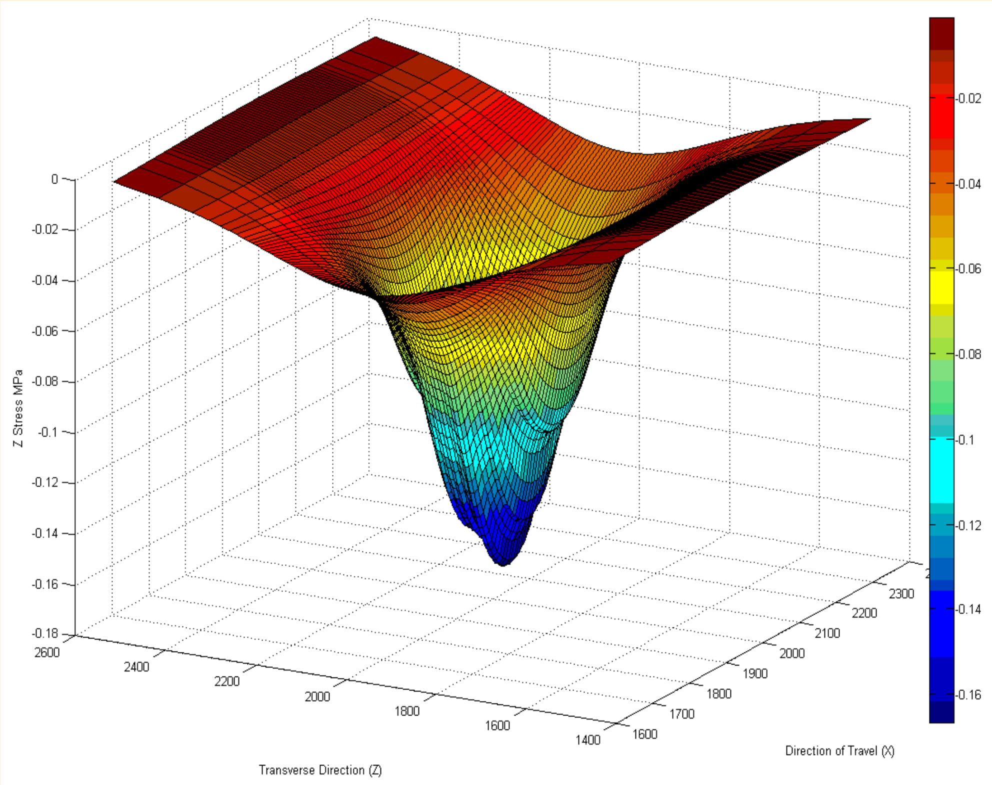


Current Research





Current Research



Thank you very much for your attention.

Go Raibh Míle Maith Agaibh

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