

stam

Science and Technology in Advanced Manufacturing

Investigation Into the Potential Of Embedded Strain Sensors for Force Measurement in Grinding Wheels

MAI Viva Presentation

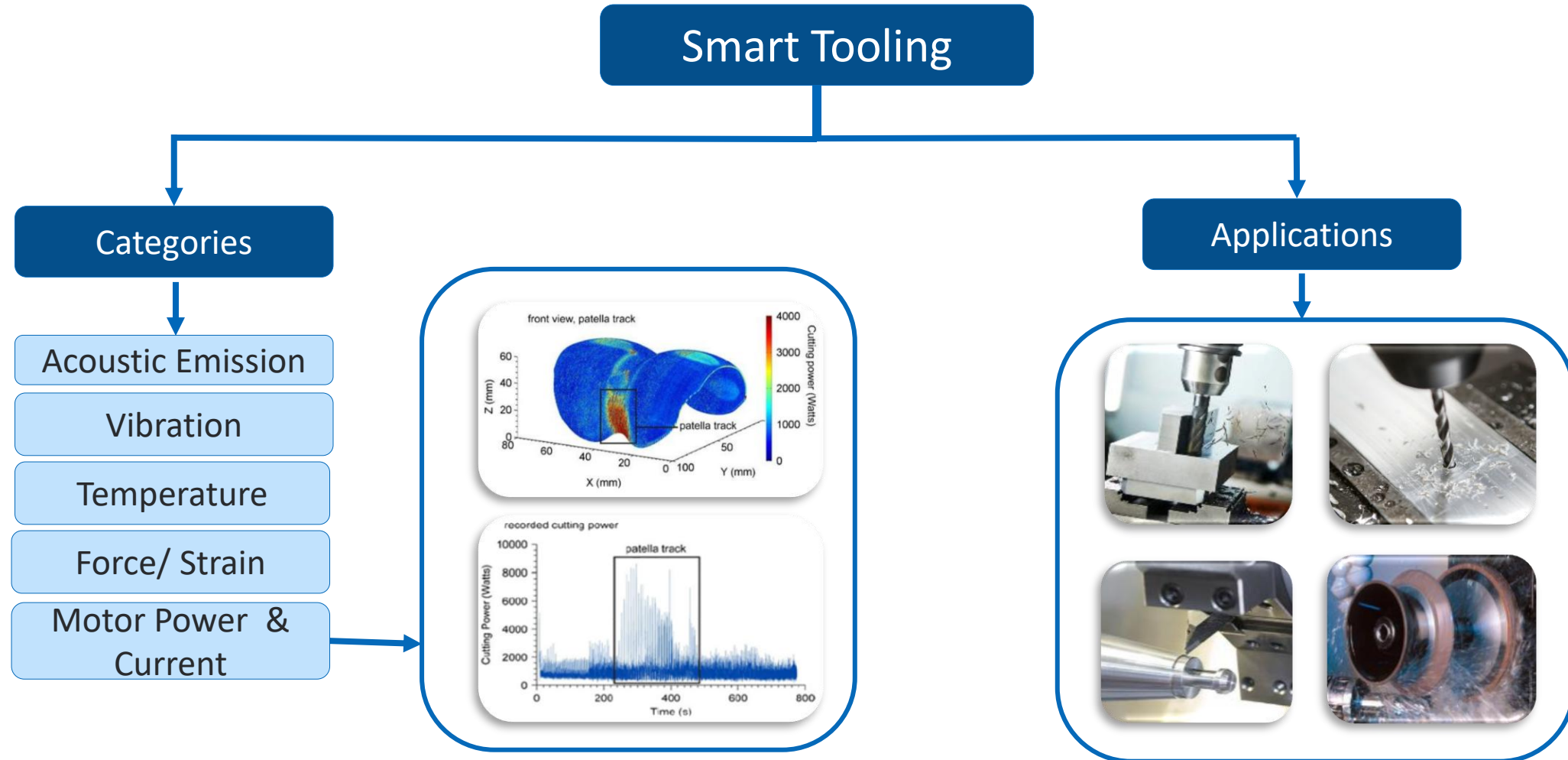
Student: William Dempsey
Supervisor: Dr. Garret O'Donnell

<https://www.tcd.ie/mecheng/research/stam/>

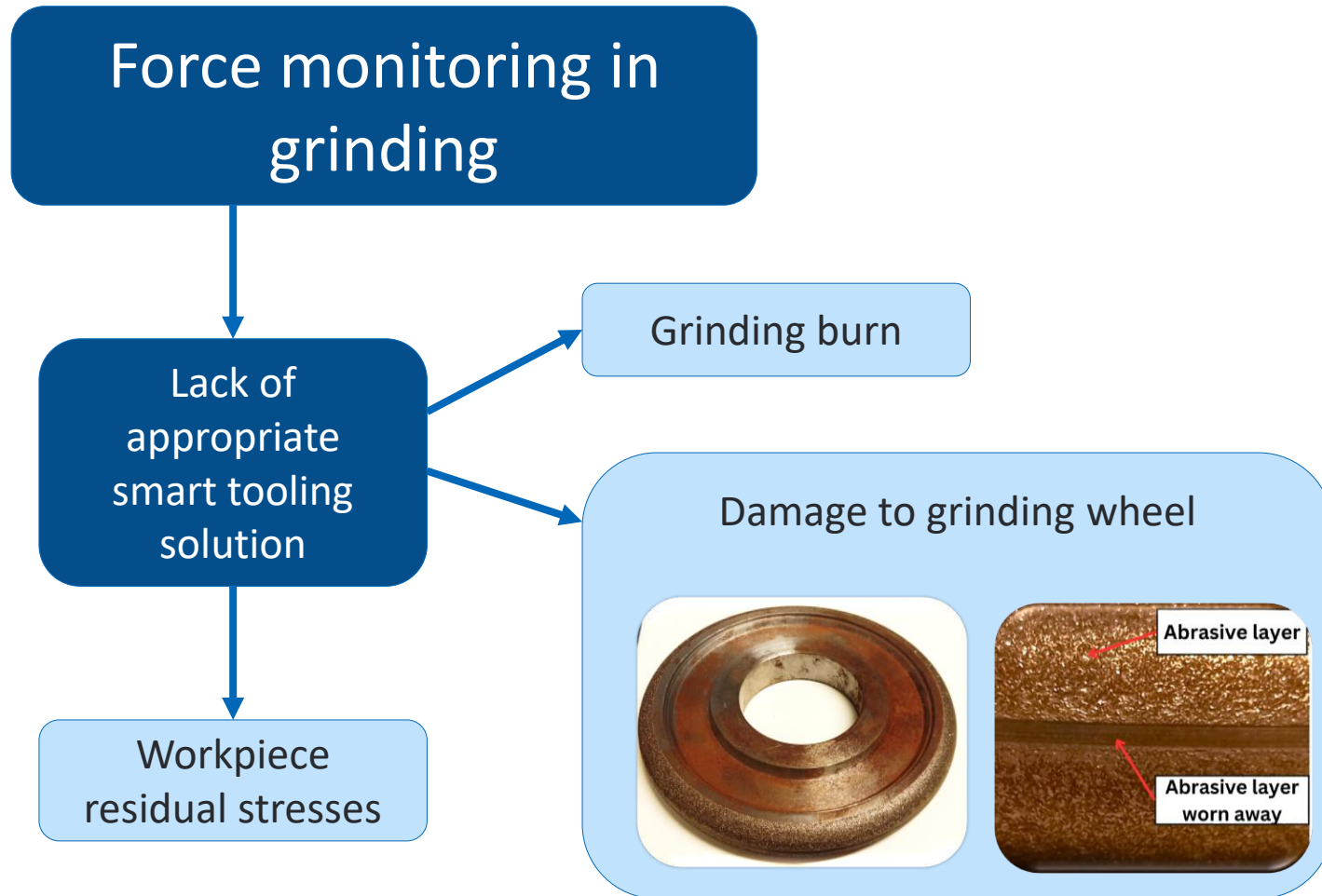


Trinity College Dublin
Coláiste na Tríonóide, Baile Átha Cliath
The University of Dublin

Research Background

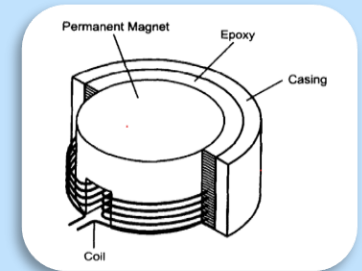
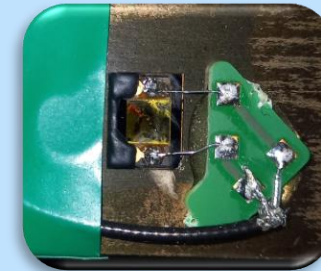


Research Problem



Potential Solution:

Embedded strain sensors



Key features:

1. Passive operation
2. Low resolution
3. Compact & lightweight
4. Embedding potential

Research Objective

“Investigate the potential of embedded strain sensors for force measurement in grinding wheels”

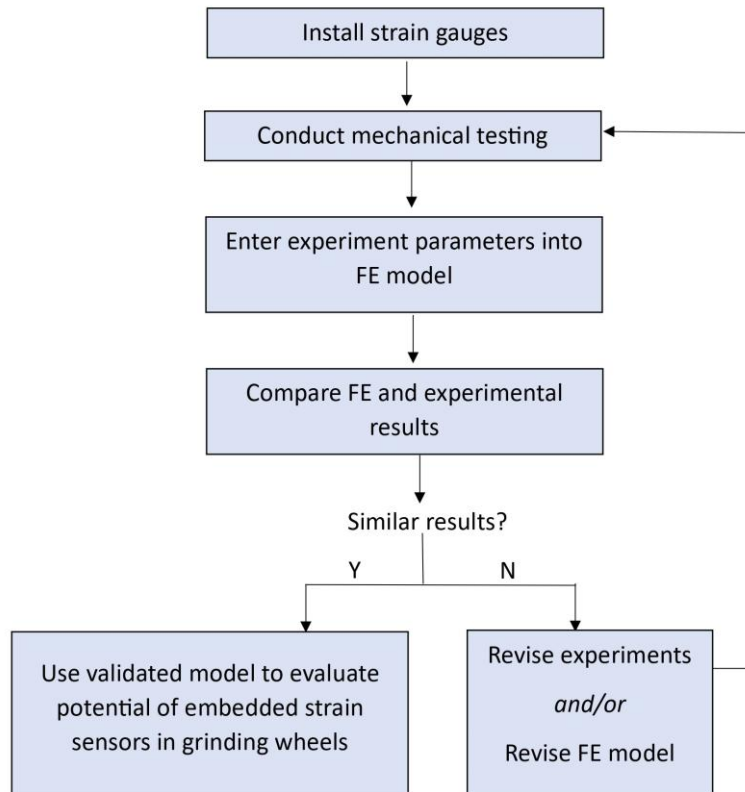
Issues to address:

1. Does strain occur in **measurable levels** in grinding wheel?
2. Does wheel strain demonstrate a **consistent relationship** with force/torque?

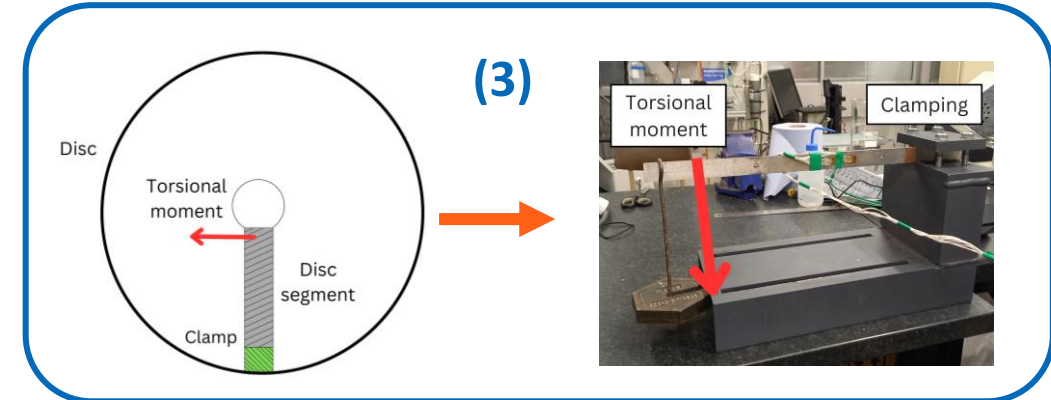
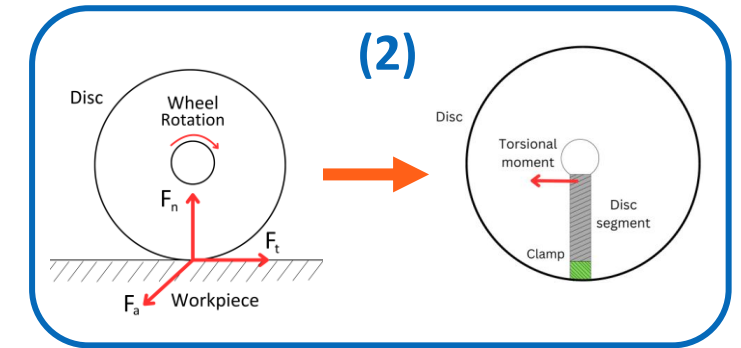
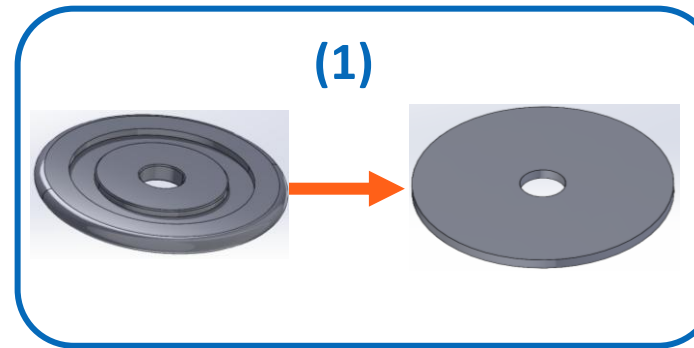


Research Approach

Combined experimental and FE modelling approach

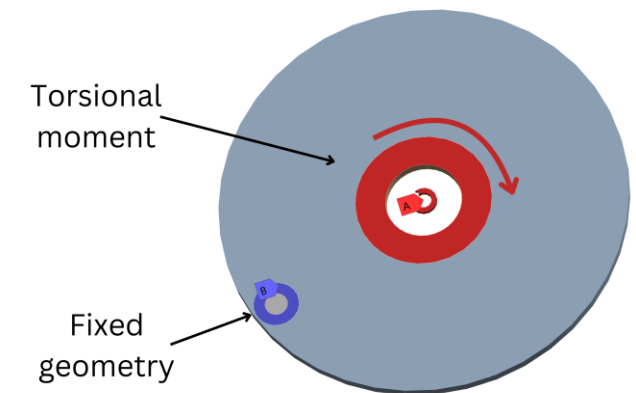
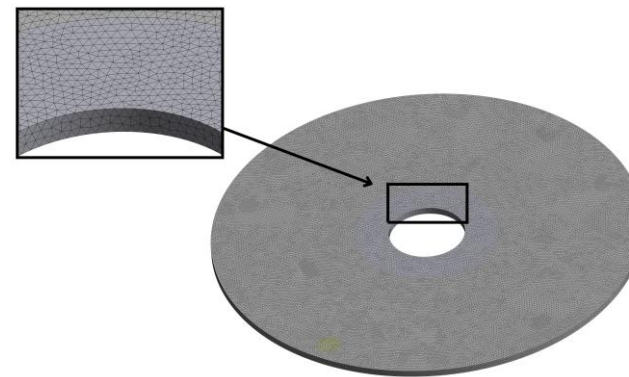
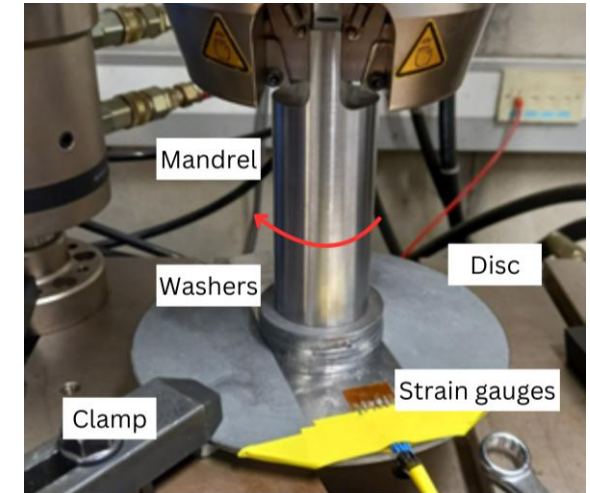
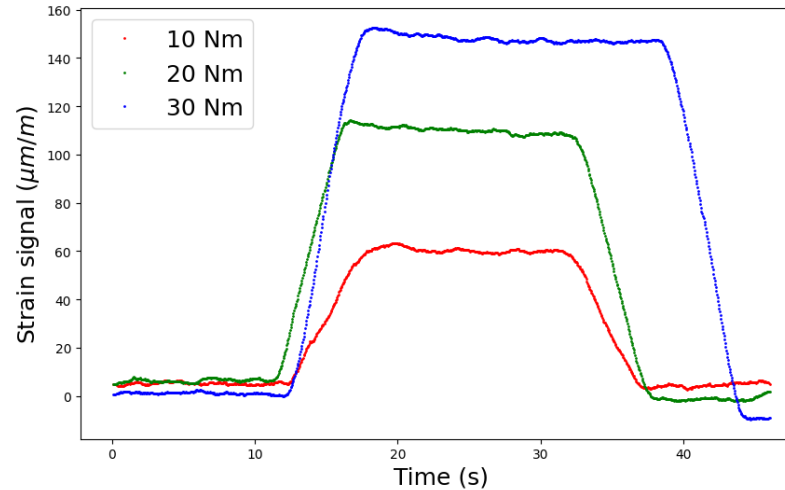


Grinding system analogies



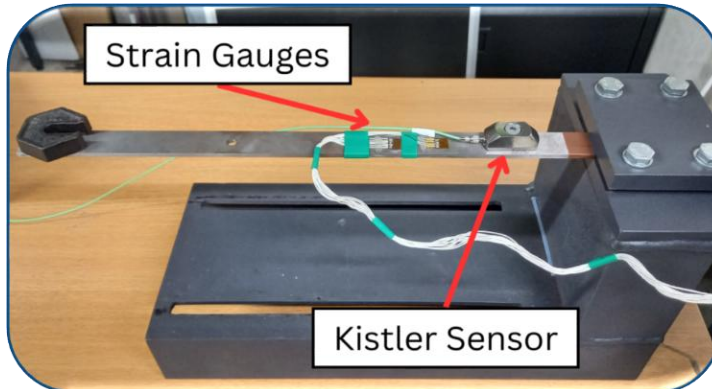
Experiments- Simplified Disc Structure

- Applied **10, 20, 30 Nm** torque
- Varied clamp position
- **Measurable** strain levels
- **Consistent strain increase** with torque/reaction force
- FE model- **poor correlation** with experiments



Experiments- Simplified Beam Structure

Bending strain experiment

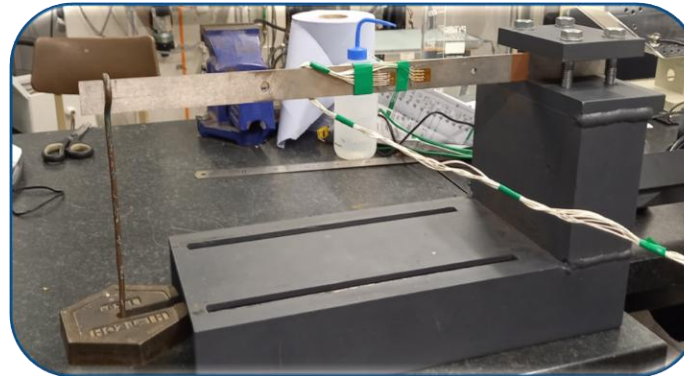


Good experimental-FE model correlation
(**within 6%***)

Improved strain **gauge application**

Confidence established in FE and sensor results

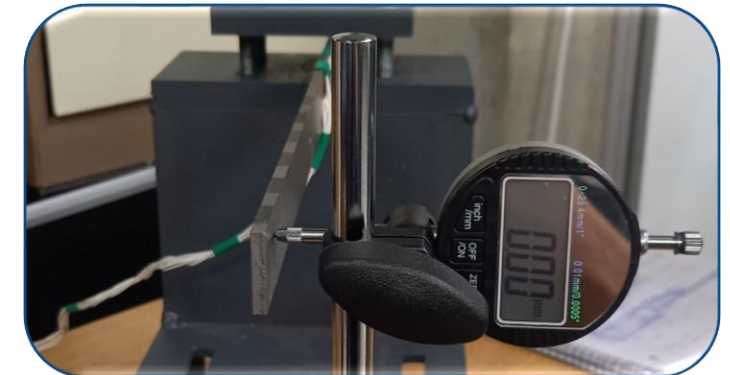
Shear strain experiment



Poor correlation

Possible **out of plane behaviour**

Beam deflection experiment

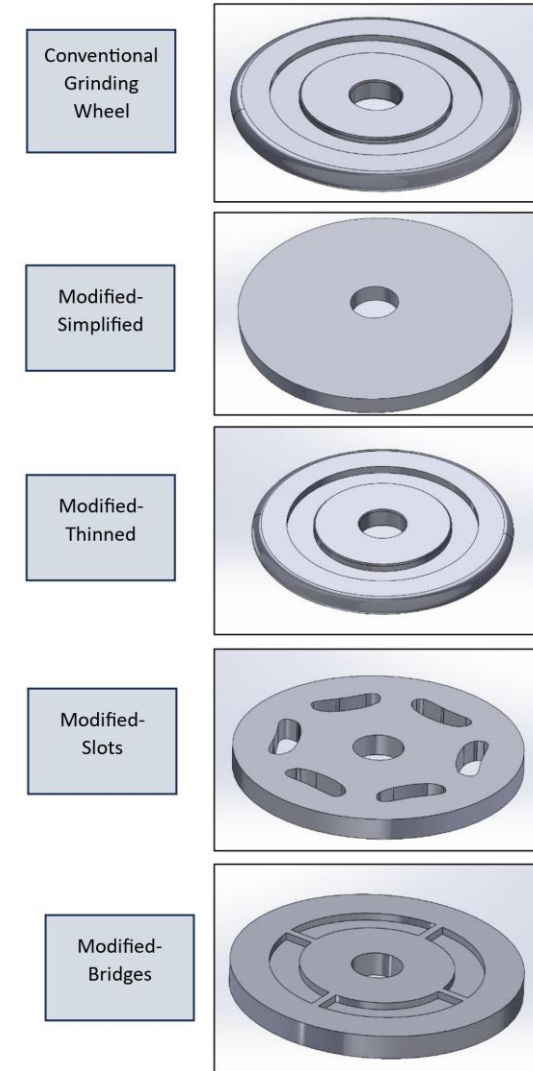
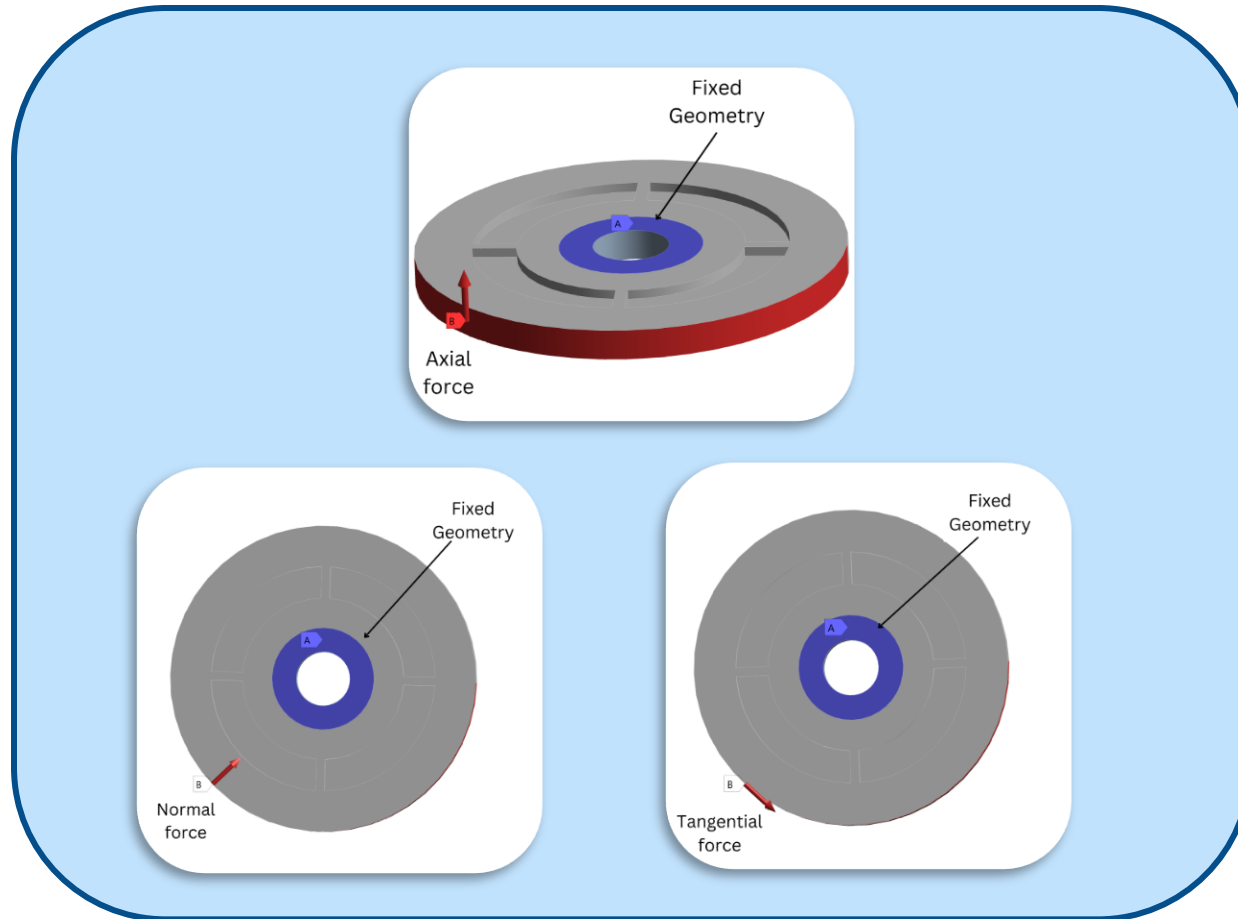


Beam **deflection confirmed**

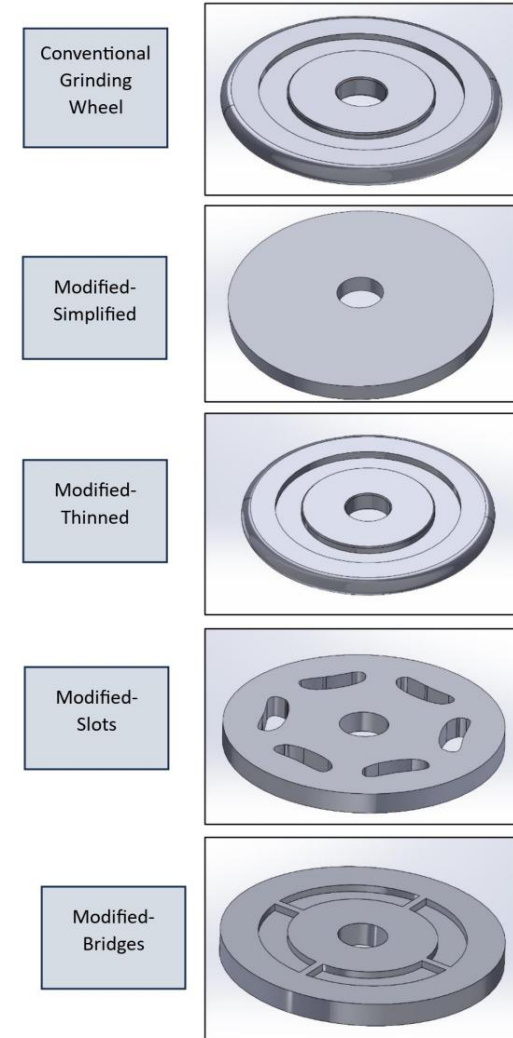
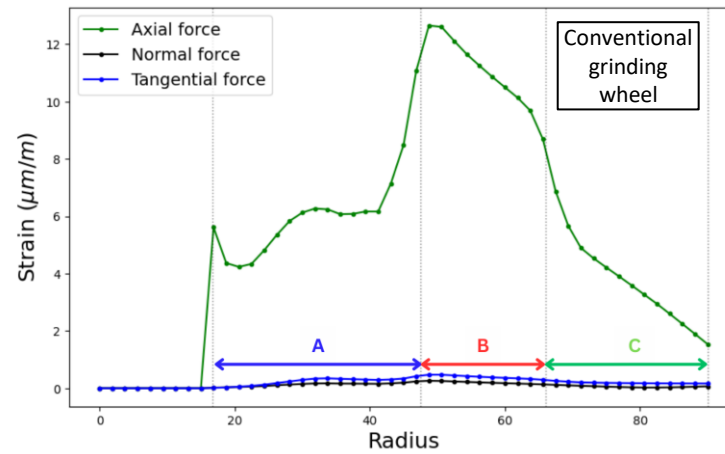
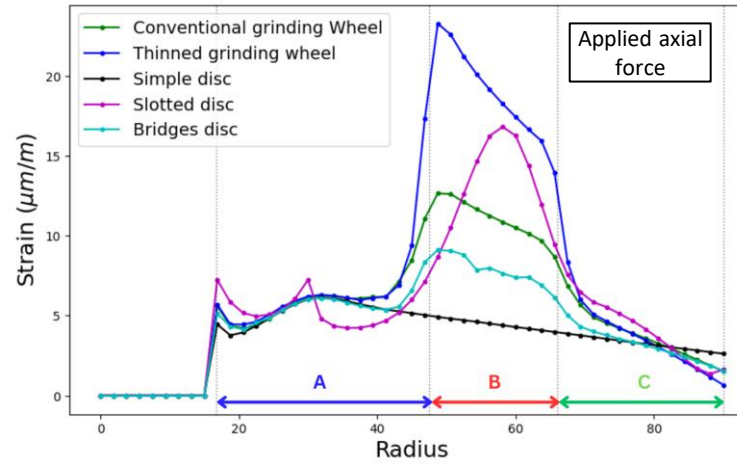
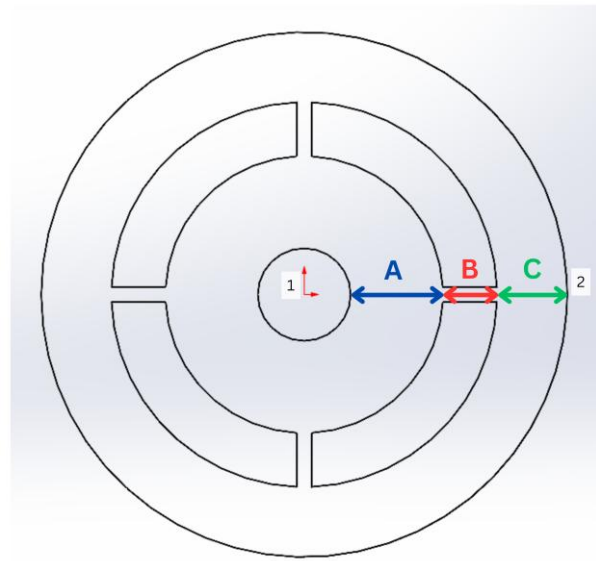
Introducing **bending strain** into measurements

*Once misaligned loading taken into account

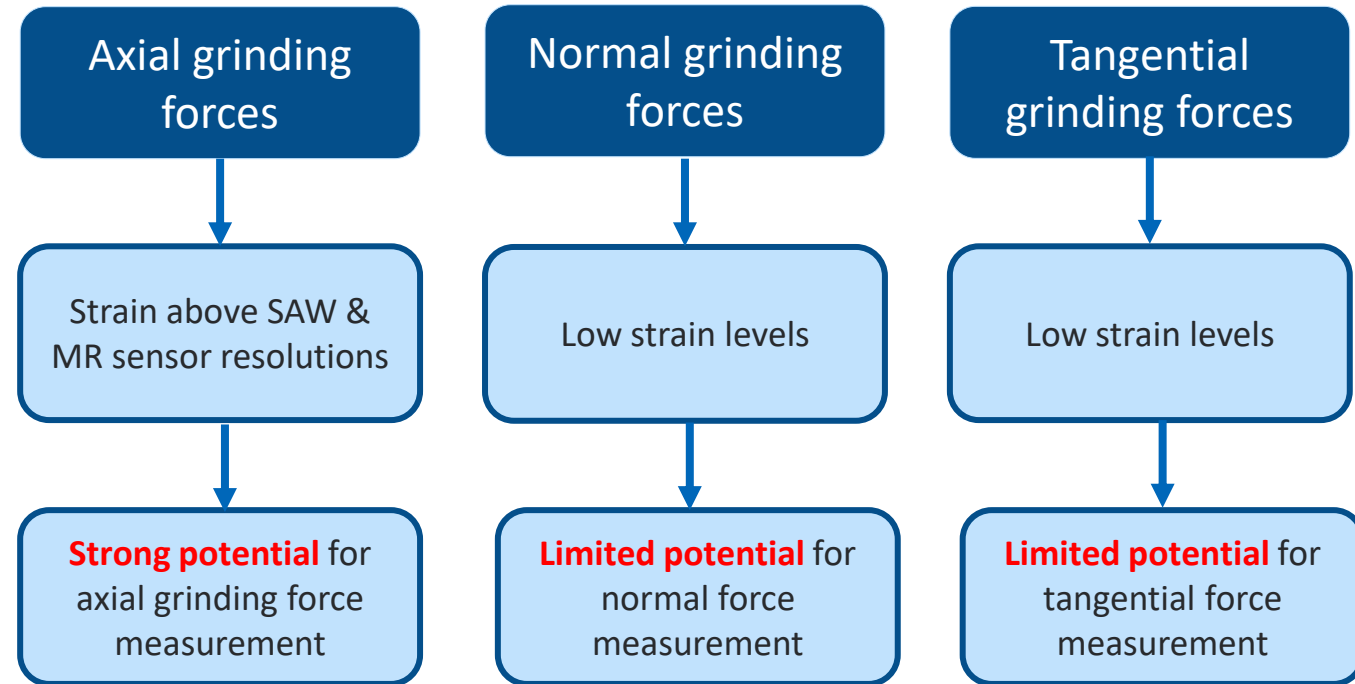
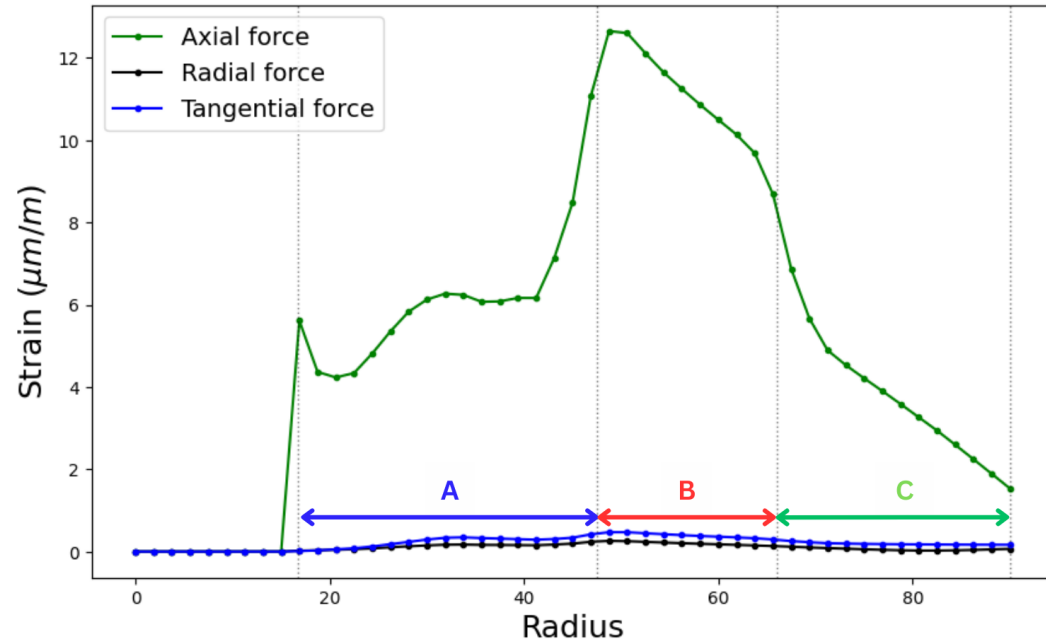
Sensor Potential Evaluation- Model Setup



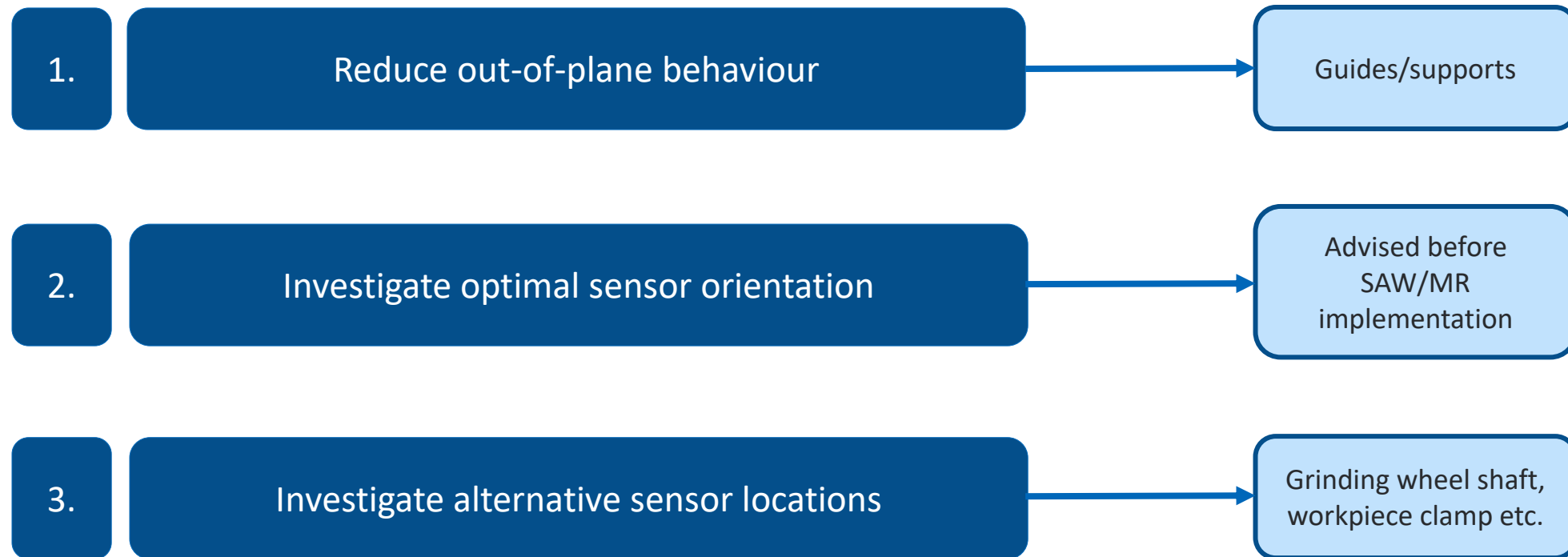
Sensor Potential Evaluation- Model Results



Sensor Potential Evaluation- Takeaways



Future Work





Trinity College Dublin
Coláiste na Tríonóide, Baile Átha Cliath
The University of Dublin

Thank You

Questions are welcome

William Dempsey
dempseyw@tcd.ie