



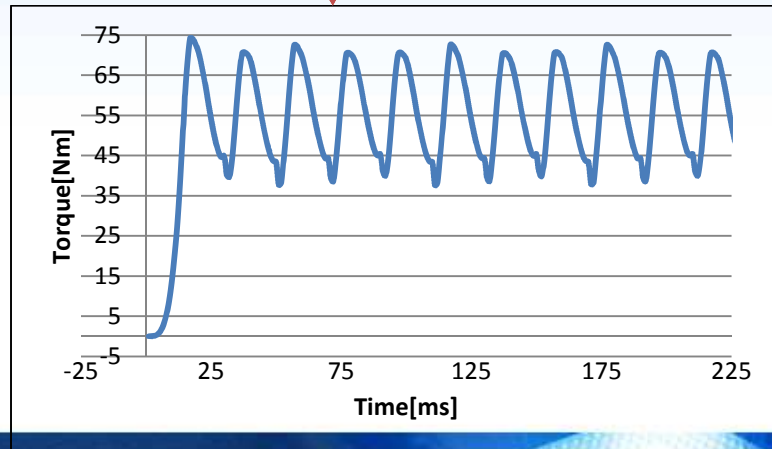
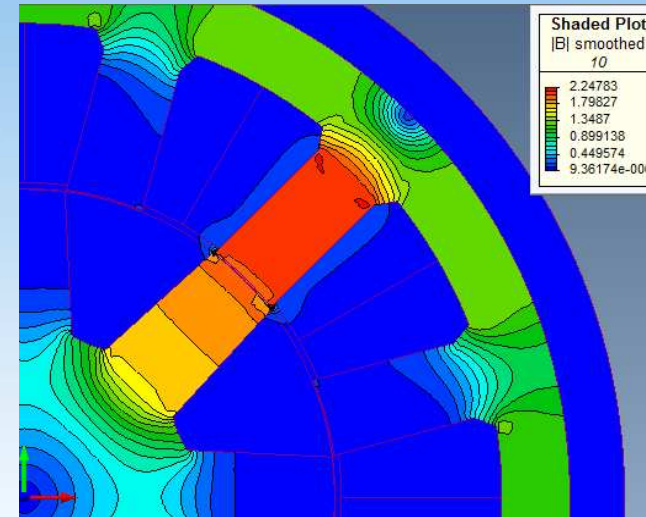
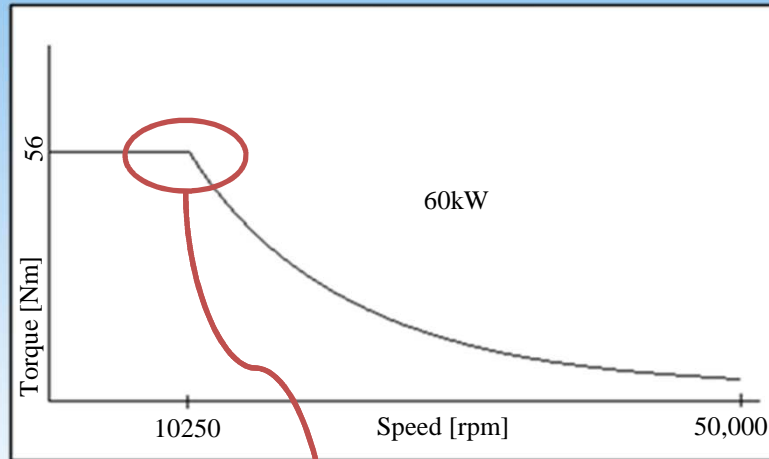
## **THEME 4 Motors**

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**Project Management Meeting  
University of Manchester  
7<sup>th</sup> April 2014**



# Electromagnetic Analysis

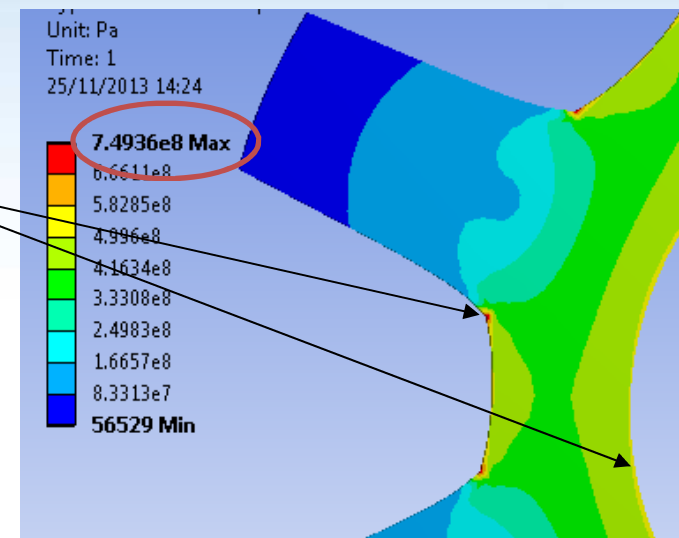


Running at 10,000rpm  
Average Torque:  
55.6 Nm



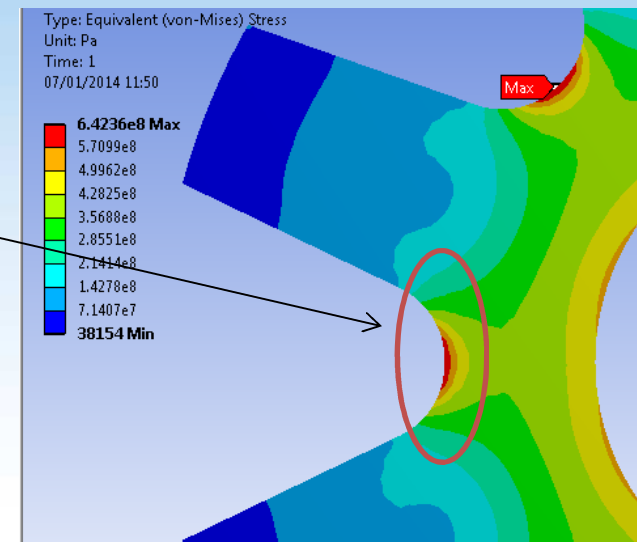
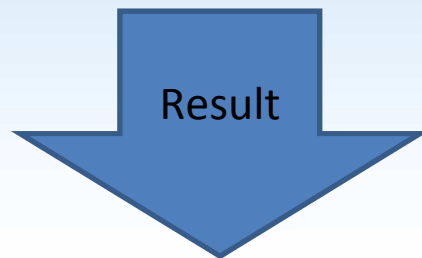
## Mechanical Constrains

- Grade M250-35HS Electrical Steel, Manufactured by Cogent Steel, Yield Strength of 400MPa
  - Simulated at 60,000rpm Considering 20% Over Speed
- Max (750MPa) on the Shaft Area and Base of the Teeth
  - Cause:
    - A. Tangential Stress (Hoop Stress)
    - B. Results of the Notch Effect



## Suggested Solutions

Step One:  
Using a Tangential Curve to  
Connect the Bases of Each Two  
Adjacent Teeth



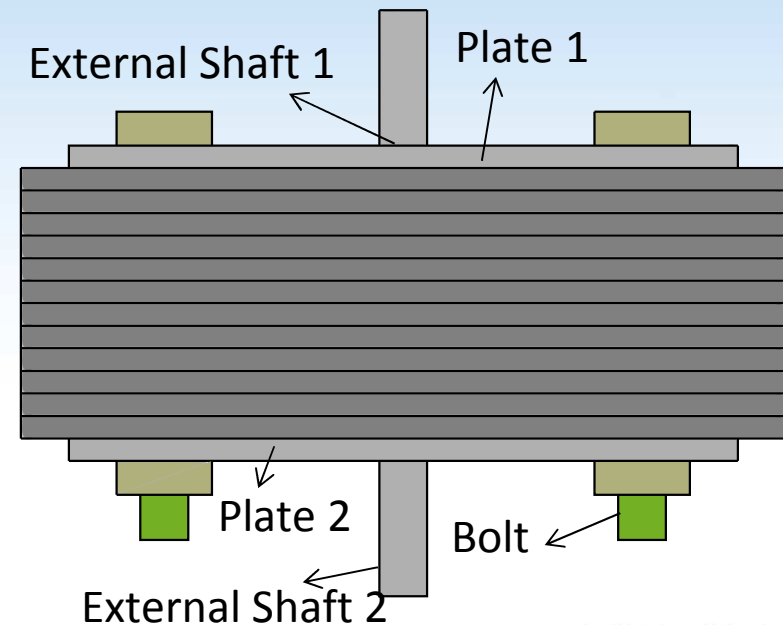
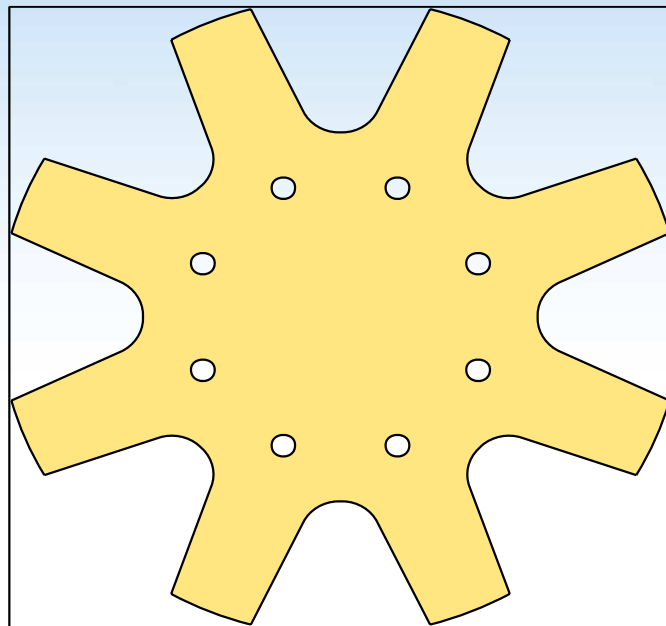
- 15% Reduction in the Maximum Stress
- 642MPa still Greater Than the Yield Strength



## Suggested Solutions

Step Two:

Removing the Shaft and Using Bolts to Hold the Laminations and the External Shafts Together\*.

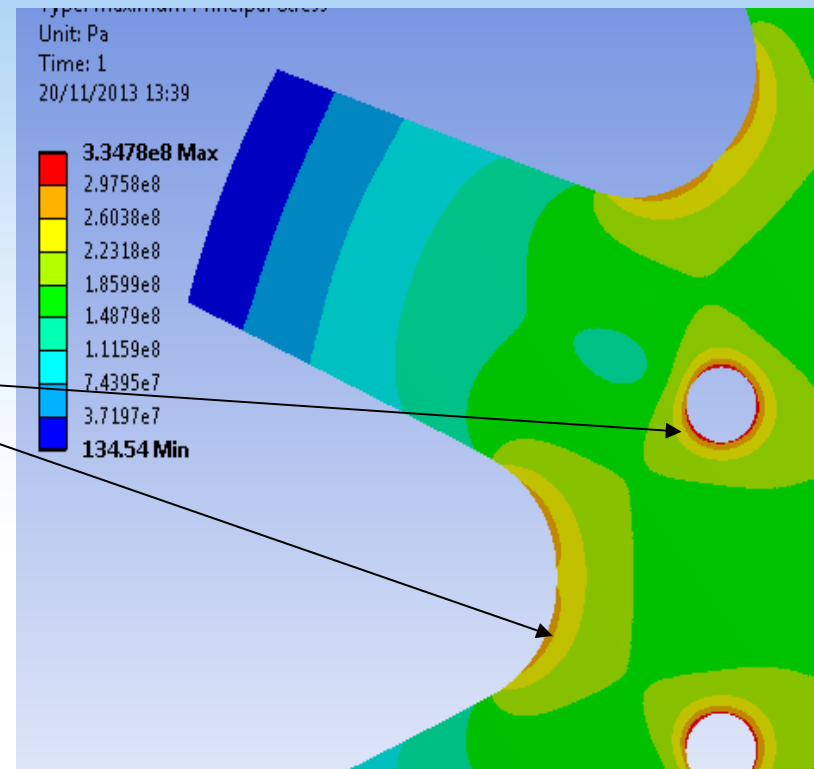


*\*Pullen, K R (2011). Flywheel Apparatus. WO Patent 2,013,038,027*



# Stress Analysis

- Simulation Run at 60,000rpm, Considering 20% Over Speed
- Maximum Stress (334MPa) Less than the Yield Strength
- Safety factor of 1.2



# Conclusion

The Analysis of the Proposed Motor Demonstrates:

- Output Torque of 56Nm
- Capability of Running at 50,000rpm and Even 20% More
- Output Power of 60Kw Can be Achieved
- A Promising Electric Motor for Automotive Applications

To Do:

- The Thermal Analysis
- Choice of Cooling Systems
- Choice of Bearings and the Balancing



# Questions?



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