Multi-Functional Magnetic Composite Materials for use in Magnetic Gear Systems

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www.bris.ac.uk/composites
Introduction

- What is a magnetic gear?
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Why the Magnetic Gear?

**Pros**
- Low maintenance, noise and vibration
- Improved Reliability
- No lubrication
- Physical isolation between shafts
- Inherent overload protection

**Cons**
- Difficult to manufacture
- Over banding required to protect brittle permanent magnet material
- ‘Block’ construction limits design freedom
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**Project Aim:**
- Incorporate ferromagnetic material into a fibre composite central magnetic gear rotor

- In order to:
  - Simplify manufacture
  - Reduce cogging torque
  - Generate a self-supporting structural component without compromising gear performance
Central Rotor Design

- **Stage 1**
  - Material property data

- **Stage 2**
  - Forces acting on central rotor during operation

- **Stage 3**
  - Generate lay-up designs to meet both the mechanical and electromagnetic requirements of the central rotor

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• Using FEMM finite element software

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Manufacture and Testing

• Incorporating ferromagnetic material into fibre composite toroid
  - Bulk particulate composite
  - Inter/Intra layer incorporation

• Need repeatable method with controlled particle $V_f$

• Gear Test Rig
  - Test rotor designs
  - Compare with theoretical models
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- Thank you for listening

- Questions?