Magnetic Gearbox

Project Detail:

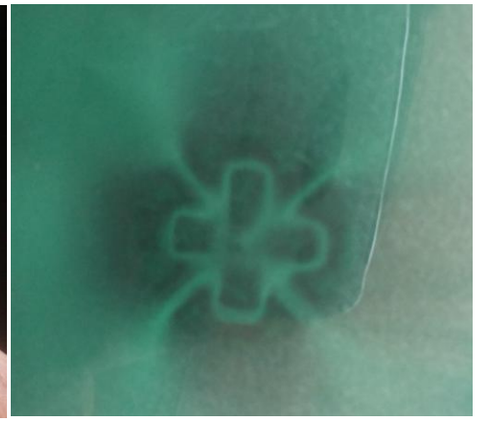
- During my undergraduate studies, I led a team of 30 to design a fuel-efficient car for the Shell Eco-Marathon, focusing on reducing drivetrain losses, air drag, and friction in the gearbox.
- While researching, I became interested in magnetic bearings and frictionless magnetic gearboxes. I studied papers on magnetic gearbox design, magnet materials, Halbach arrays, magnetic fields, and pole arrangements. This led me to build a prototype gearbox and test it to better understand its functionality.
- I sourced Neodymium magnets locally and imported magnetic film from the USA to study magnetic poles.- Secured sponsorship for two torque sensors from Sensor Technology Ltd, UK, to test the prototype. I also developed fixtures to manufacture and assemble the middle ring of the gearbox using cold-rolled, non-oriented soft iron lamination. The gearbox, with a 3:1 ratio, was tested using the torque sensors, achieving a maximum output torque of 2.87 N-m.

Learnings:

- Developed an understanding that a gearbox with a smaller pole width and a higher number of poles ensures smoother operation and reduces jerks.
- Realized the need to design an electromagnet stator that integrates motor and gearbox coils for more efficient performance.
- Learned that utilizing magnets of different shapes can enhance the strength of the magnetic field.

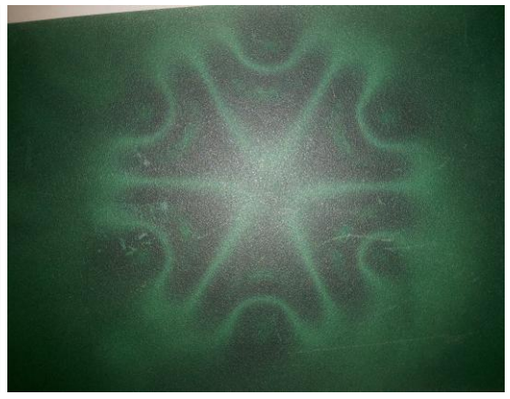
- **3D Printed Rotor of Prototype 1:**

- **Rotor four Poles viewing using magnetic film:**

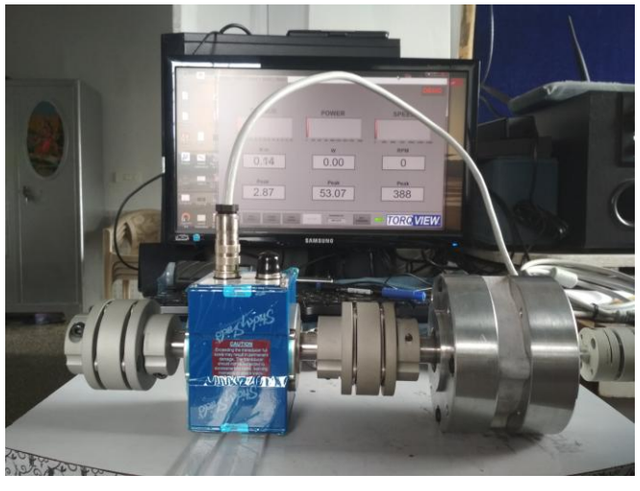


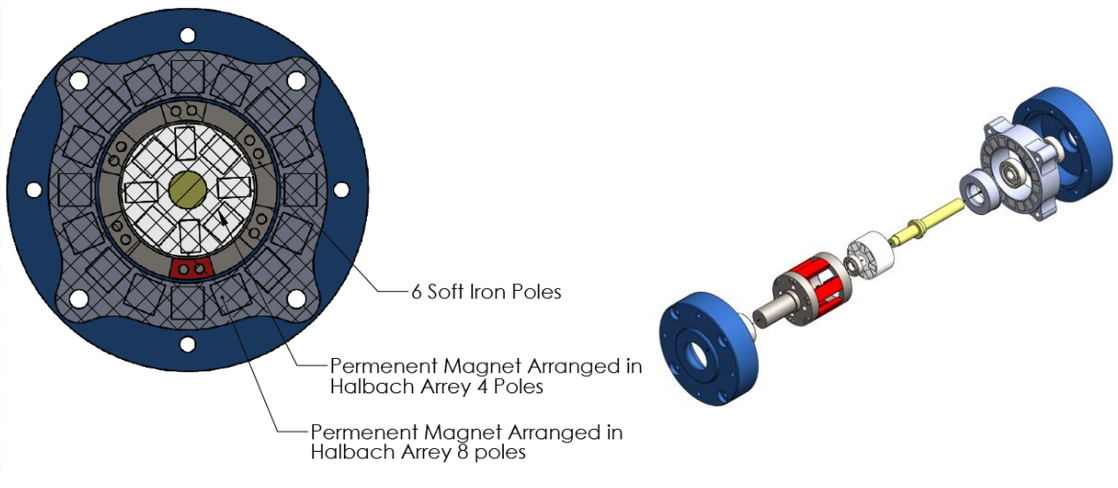
- **3D Printed Stator of Prototype 1:**

- **Stator six Poles viewing using magnetic film:**



- **Functional Prototype 2 of Magnetic gearbox attached to torque transducer to measure slip torque:**





- **Prototype 1 of Magnetic gearbox for proof of concept:**