Novel topologies for magnetic gears

Sarah Kelly*[1] and Markus Mueller[2]

[1]University of Strathclyde – United Kingdom
[2]University of Edinburgh – United Kingdom

Abstract

Magnetic gearing systems are being investigated for renewable energy converters as a replacement for mechanical gearboxes. Unlike a mechanical gearbox, there is no contact between the rotating parts between the low and high speed shafts, which given the reliability issues with conventional gearboxes is a major advantage of magnetic gear technology. An existing CDT student, Ben McGilton, is designing and building a rotary magnetic gear for testing over the summer. An example of rotary magnetic gear is shown in the picture to the left, in which the grey parts are ferromagnetic material and the red and blue parts represent permanent magnets of opposite polarity. The outer magnets are the low speed side and the inner magnets are the high speed side, with a ferromagnetic ring in the middle. An airgap exists between each magnet section and the ferro-magnetic poles in the middle. In this example the magnets are radially magnetised so that the flux crosses the gap in a radial direction. In electrical machines alternative magnetisation topologies have been demonstrated which result in an increase in torque density, Nm/kg. For example a Halbach array (see picture to the right) in which the magnets are magnetised in the circumferential and radial directions can increase the airgap magnetic flux density and reduce mass, as an iron coreback is no longer necessary. Other techniques for increasing flux density are the use of buried magnets and transverse topologies, all demonstrated successfully in electrical machines. In this project you will investigate the potential of such options in magnetic gears, with some modelling to compare the different topologies in terms of performance, but also manufacturability.

Keywords: Magnetic Gears Topologies Novel

*Speaker