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MAGNETIC CONTACTLESS NON-CONCENTRIC GEAR TO DOUBLE THE SPEED ON HIGH SPIN DRIVING

João Beltrão Costa[(1)], António J. Arsénio Costa[(2)], João F. P. Fernandes[(3)], Hugo Morais[(4)]

[(1)]MSc Student, IST
[(2)]INESC-ID
[(3)]IDMEC, IST
[(4)]INESC-ID, IST

joao.beltrao.costa@tecnico.ulisboa.pt, antoniojcosta@tecnico.ulisboa.pt, joao.f.p.fernandes@tecnico.ulisboa.pt, hugo.morais@tecnico.ulisboa.pt

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Summary: The use of magnetic contactless gears will enable speed conversion at high velocities with zero friction losses. These do not need lubrification reducing the required maintenance. Magnetic contactless gears protect structures and mechanisms against overloads. Another benefit is their ability to transmit power through walls without requiring joints or seals. The cancellation of friction in motion transmission will contribute to significant improvement of electric vehicles' efficiency and thus extend the batteries' lifetime.

The objective is to present a framework concerning the definition of the optimum arrangement of magnets for a non-concentric gear to double the speed of high spin driving. The gear comprises two radial magnetic flux wheels. The magnetic coupling between the two wheels is done by the interaction between their radial magnetic fluxes. The number of magnetic poles from the primary wheel is half of the secondary wheel. Two different permanent magnet sizes commercially available are considered, one deployed on the primary wheel and the other on the secondary wheel.

Combinations of compressed and non-compressed radial magnetic fluxes are compared in terms of the maximum generated torque and magnetic force between the two axes. The different combinations of topologies are first compared considering keeping the primary and secondary wheels' radius and, the distance between the primary and secondary axes. Calculation of magnetic forces and torque is to be done numerically by finite element analysis.

In the second stage, a parametric optimization of the wheels' radius and the distance between the wheel's axes is done to minimize the cogging torque for the topology combination providing the highest torque. Efficiency is to be estimated by predicting the expected energy dissipation in residual torque ripple. The dimensional design and predicted characteristics for the more efficient gear topology will be presented.