Unbalanced Torque Signal Generation for Kinetic Energy Harvesters

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Abstract

The problem of an unbalanced mechanical torque signal generation using nonpolar repulsion techniques is studied. To achieve such an unbalanced torque, several stator and rotor geometries, consisting of nonlinear permanent magnet spring batteries are investigated. It can be shown that an unbalanced torque signal is feasible in a narrow unbalanced torque window, when in addition to a rotary movement also a translatory movement is added. The study examines a translatory movement perpendicular as well as in the same plane as the rotary movement.
The verification is done using the AC/DC module of COMSOL Multiphysics® software. A full 3D study simulation is used without any interaction of other physics interfaces and no models from the application libraries are used.
The obtained results from the 3D FE calculated COMSOL tool match well the analytically approximated results. It coud be shown that using the analytically approximated model, the computation time can be reduced by factor 6000 and that such an approximated model is most useful in finding fast and reliable geometry configurations for such unbalanced torque signals.

Figures used in the abstract
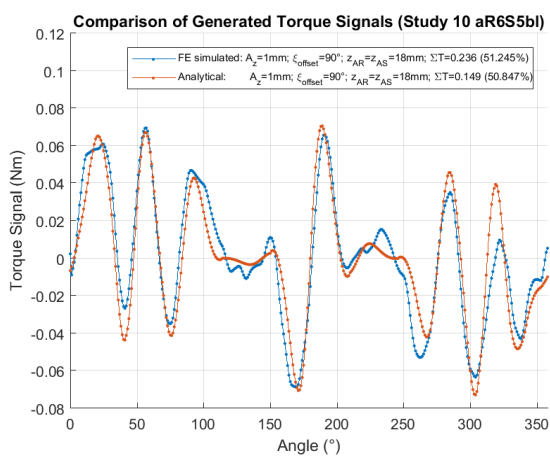
Figure 1: Generated torque signals with FE simulation and analytically approximated using harmonic axial distribution of rotor and stator permanent disk magnets.