Utilization of linear and rotating bearingless motor technologies for industrial motion control applications

WHAT AND WHY?
This project aims to develop bearingless motor technology solutions, which are valid for both rotating machinery and linear motion control applications. The technology offers integration of motor and magnetic levitation providing smaller footprint, higher efficiencies, lower cost, and oil-free operation compared to existing solutions. New motion applications can be created.

HOW AND WITH WHOM?
World’s biggest bearingless motor (160kW 30 000 r/min air compressor) and magnetic levitated mover designs, including: mechanics, thermal, CFD, modelling, control, and new custom sensors, have been completed. Manufacturing has been done at LUT and Etteplant. Collaborating partners: The Switch Yaskawa, Visedo Danfoss, Axco Motors Danfoss, LUT. New partners include: Tamturbo, Climeon, Atlas Copco. Working LUT team from Laboratory of Control Engineering and Digital Systems, Machine Dynamics, Fluid Dynamics, and LUT Voima.

RESULTS, IMPACT AND RECOMMENDATIONS
We have achieved prototyping the technological components that have been considered as short stoppers for the industrial implementation due to cost, complexity or manufacturing challenges. Therefore, good assessment of technological and economic feasibility in view of selected applications of bearingless technology could be achieved. The project provides solutions for such applications as vertical trains, elevators, internal factory or warehouse transporting systems, compressors, pumps fans, turbines and linear and rotating bearingless energy conversion.

What next?
For flux switching permanent magnet (FSPM) bearingless motor, more affordable monorail configuration will be prototyped in the future. For SPM bearingless motor, the industrial application for the pilot will be water treatment air blower. Presently we are looking into new funding acquisition from EAKR for those actions.

(a) 160 kW 30000 r/min SPM bearingless motor as two single stage compressor (manufacturing of parts LUT and Etteplan undergoing)
(b) Position sensor for permanent magnet flux-switching linear levitated mover