Nanothrust, GOOD, Power Beyond, Center of Excellence projects

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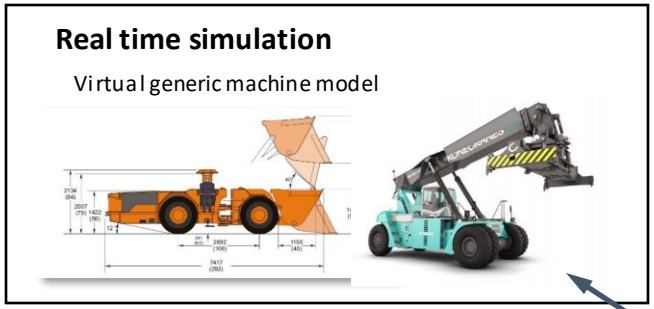
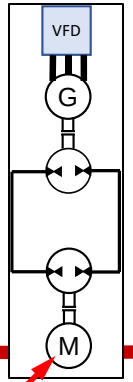
GOOD - Future electrified mobile machinery for harsh conditions

- Improve energy efficiency and performance of heavy duty electrified mobile work machines.
- Build a research platform (flagship demonstrator) for system level analysis as well as experimental testing of machine subsystems
- Study impact of different work cycles on energy consumption and the effect on the DC link. Also study thermal management and management of peak loads.
- Study reliability aspects, such as torsional vibrations, utilization of predictive condition monitoring techniques, and virtual sensors

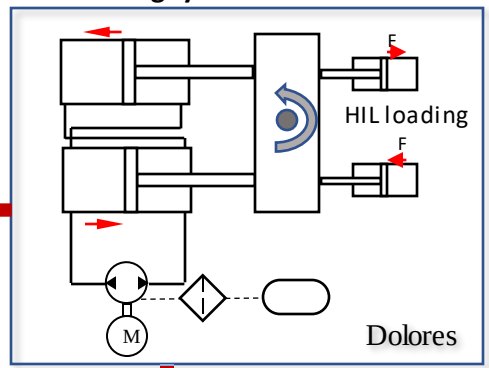
FLAGSHIP DEMONSTRATOR: Research Platform for Mobile Electrical Machine



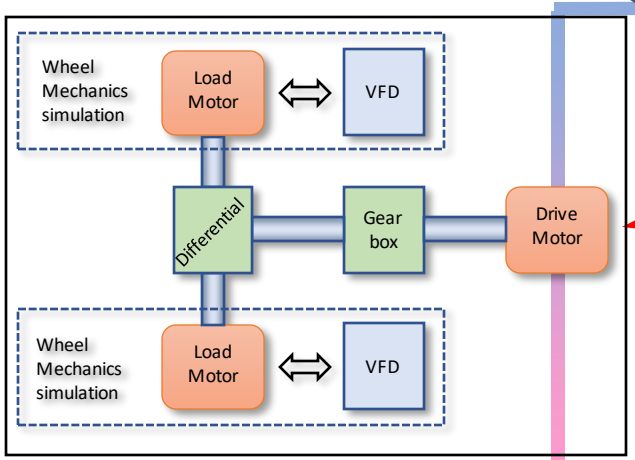
Hydraulic Aux Powerpack



Steering cylinders



Heat exchanger and filter



Drive Motor System

VFD

VFD

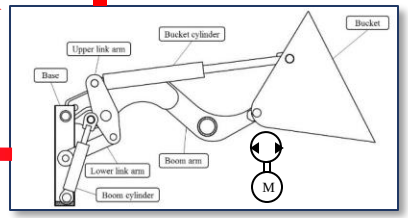
DC link

VFD

VFD

Thermal Management

- Wheel motors
- Brake resistor
- Pump motors
- Pump case flushing



Bucket Cylinders' Hydraulics

BATTERY (emulator)

Brake resistor

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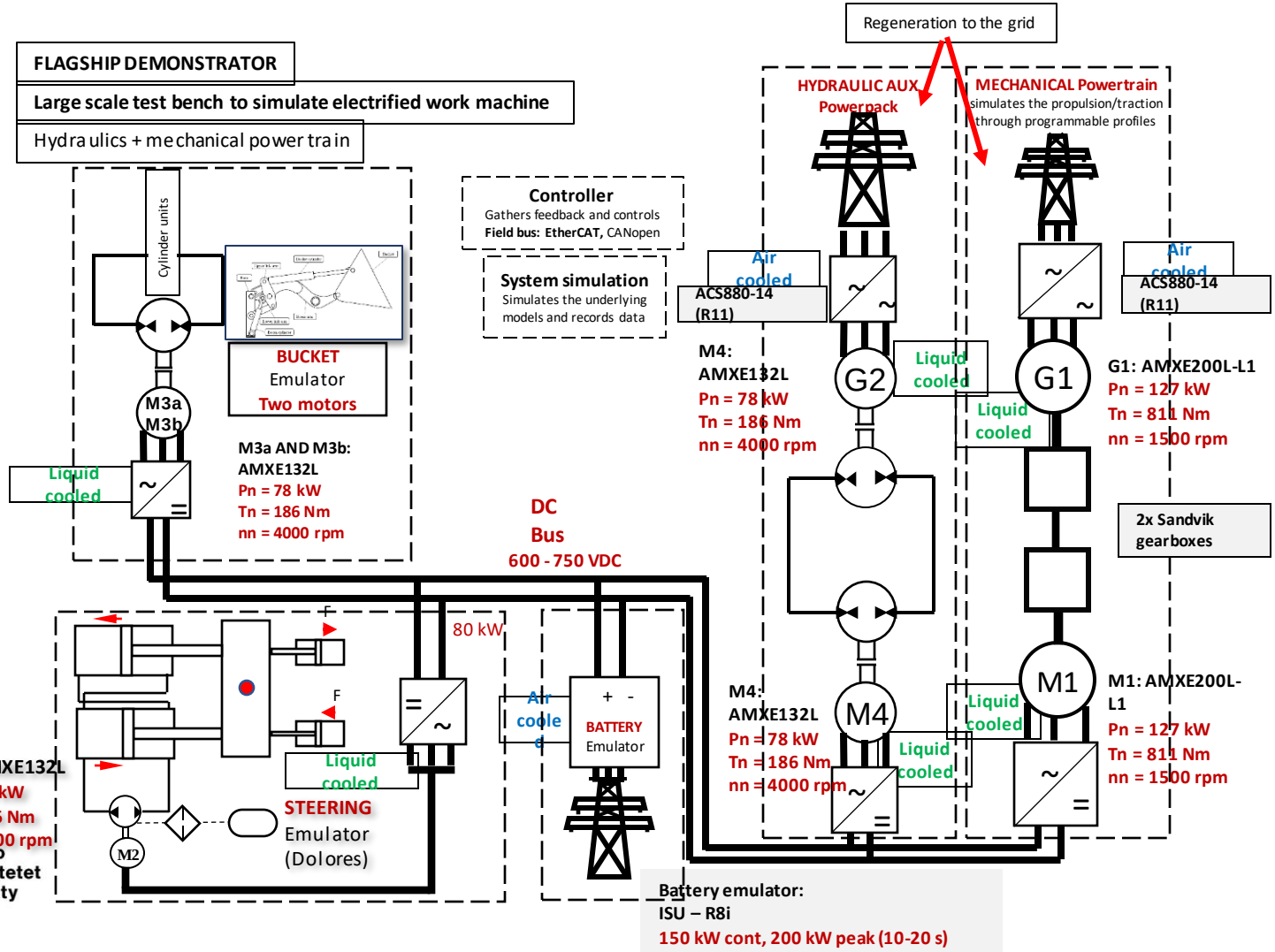

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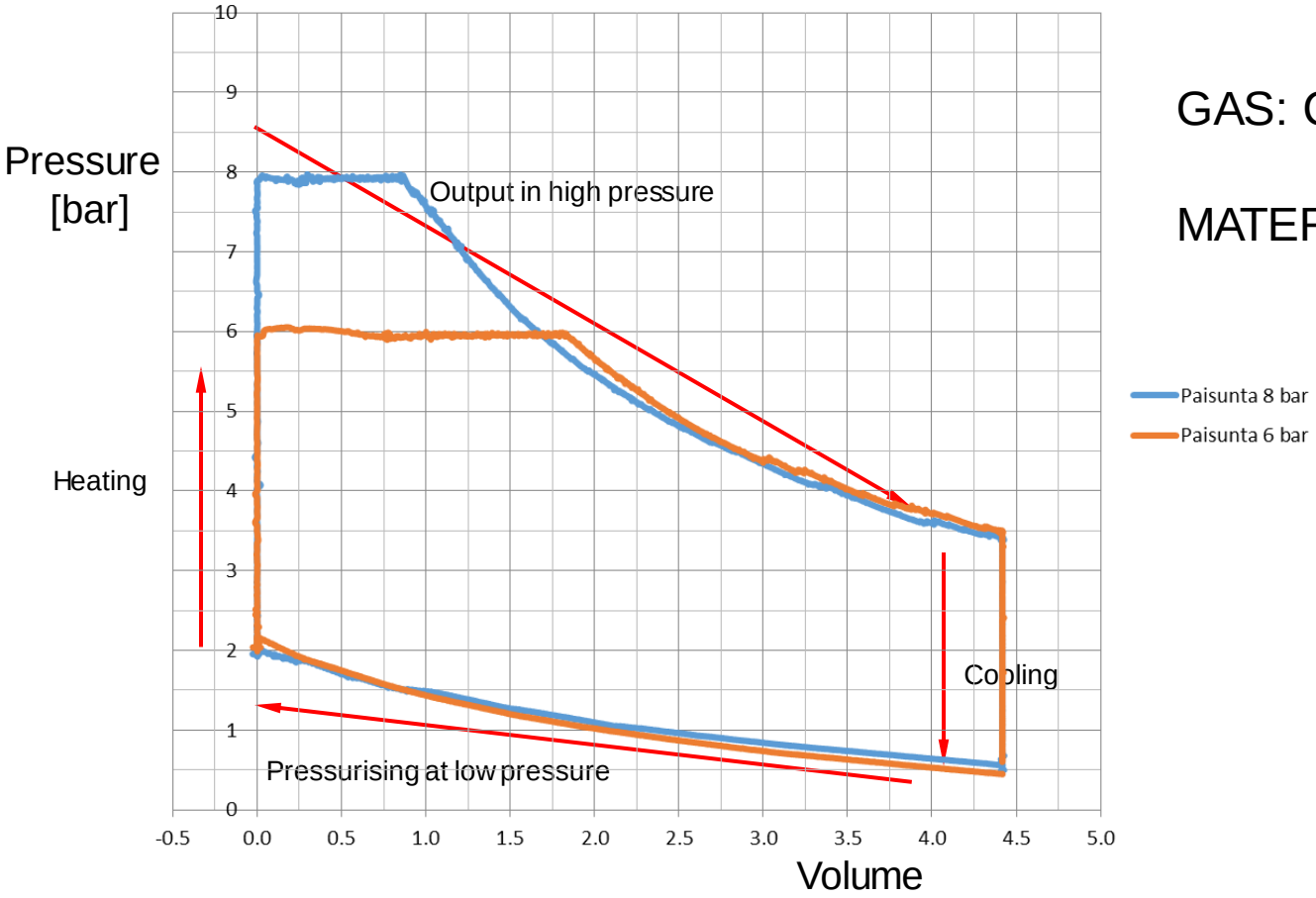
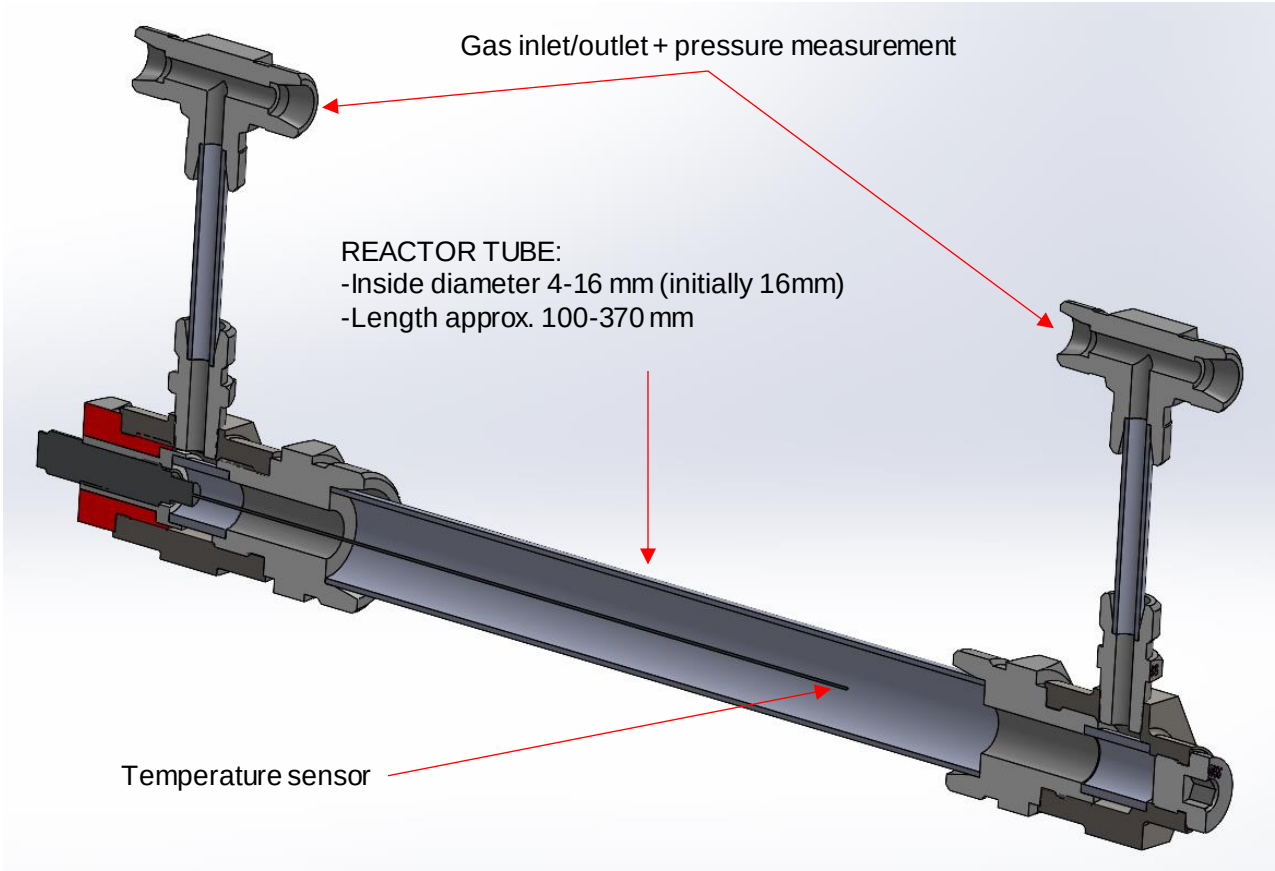


GAS: CO2

MATERIAL: ACTIVE CARBON

Measurement setup

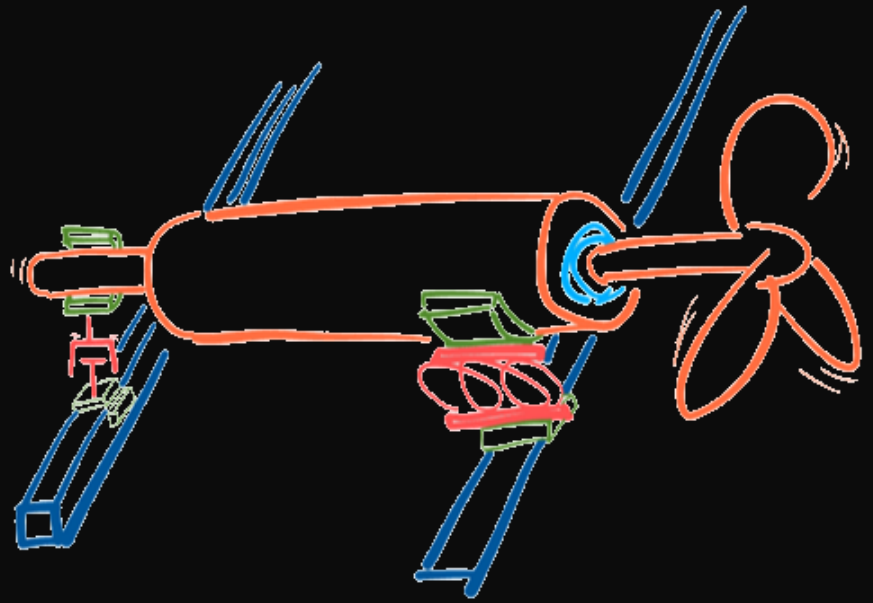


POWER Beyond

Process optimization with friction- and vibrationless technologies for energy efficiency and circularity

Part of Valmet Veturi ecosystem
funded by Business Finland

9/2022 – 8/2025



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Main goals of the project

1. **Develop frictionless aerostatic bearings for industrial use**

2. **Seals**
   a) Remaining useful lifetime estimation of lip seals
   b) Replace common seal types with aerostatic seals

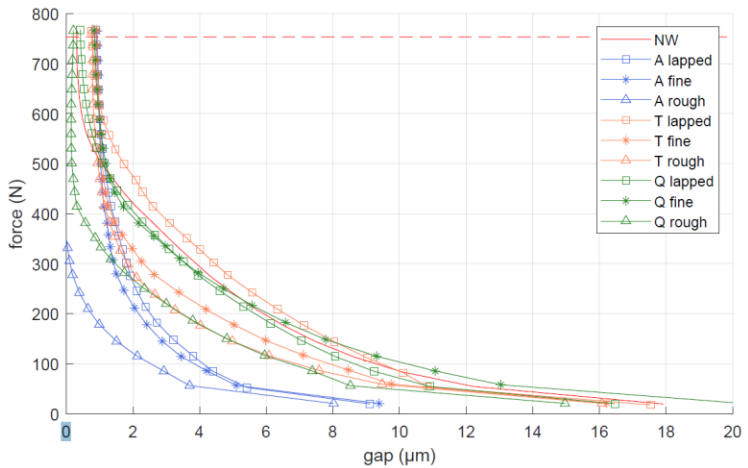
3. **Improve machine dynamics in industrial processes**

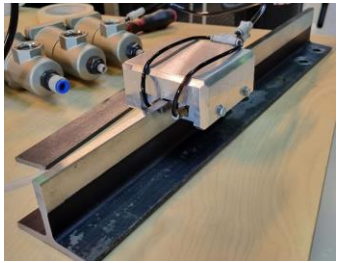
Valmet KONE KONGSBERG TIIVISTETEKNIIKKA TIIVISTEKESKUS Dynator FOR YOUR EXCELLENCE Etteplan VIBROL VIBRATION IN CONTROL FIELLBERG

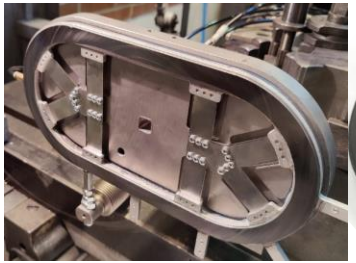
Highlights 1

Established cabability to manufacture aerostatic bearings

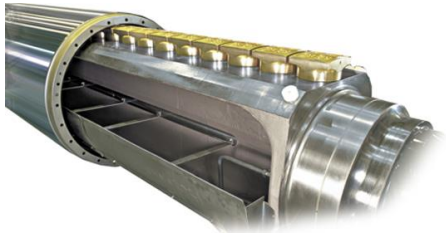
Lot of practical research work

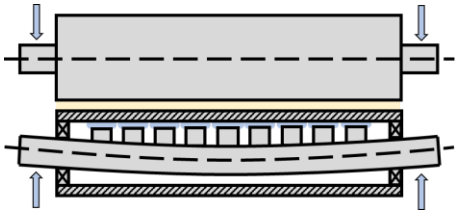


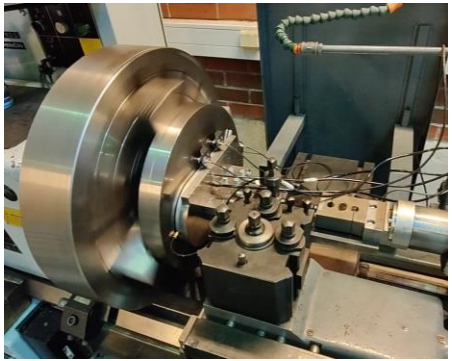


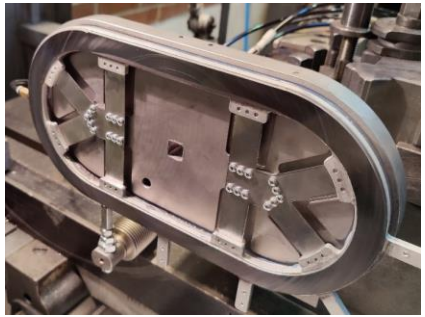


Highlights 2









Case

Planar demonstrator[1]

Down-scaled process demonstrator

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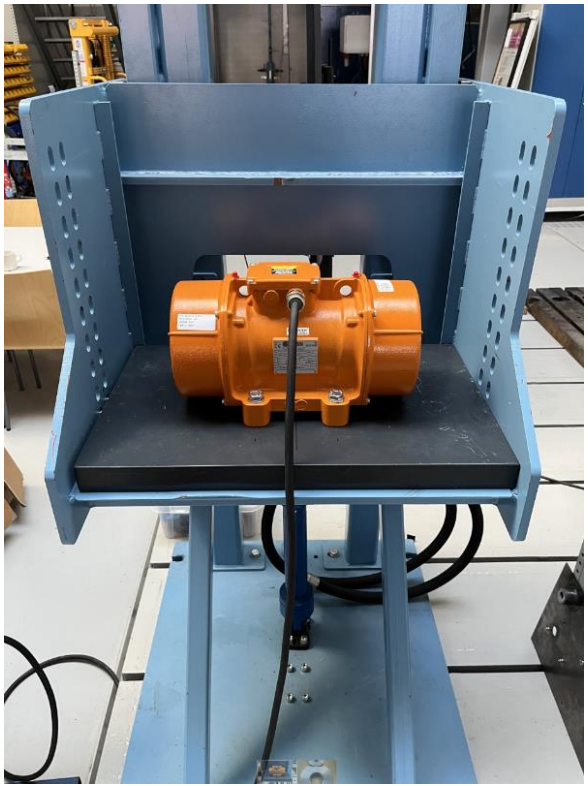
[1] Miettinen, M., Vainio, V., Theska, R. and Viitala, R., 2022. Aerostatically sealed chamber as a robust aerostatic bearing. *Tribology International*, *173*, p.107614.

Highlights 3

Adaptive vibration damper

Helmholtz-resonator with variable volume controls stiffness of a hydraulic cylinder



HiECSs

High-Speed Electromechanical Energy Conversion Systems

Center of Excellence
funded by Academy of Finland

2022 – 2029

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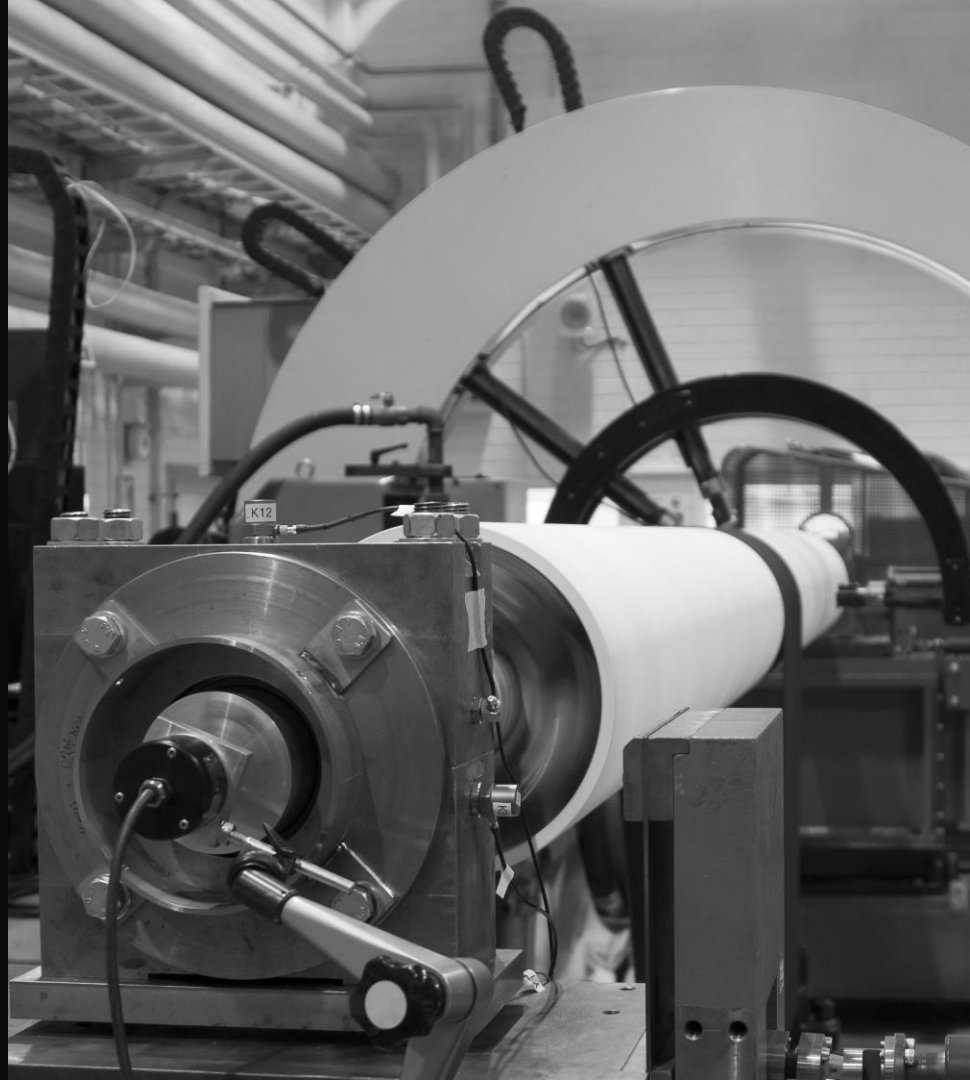
LUT
University

VTT

Tampereen yliopisto
Tampere University

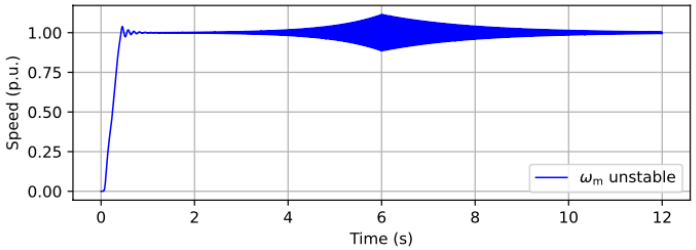
CSC



ARotor research focus

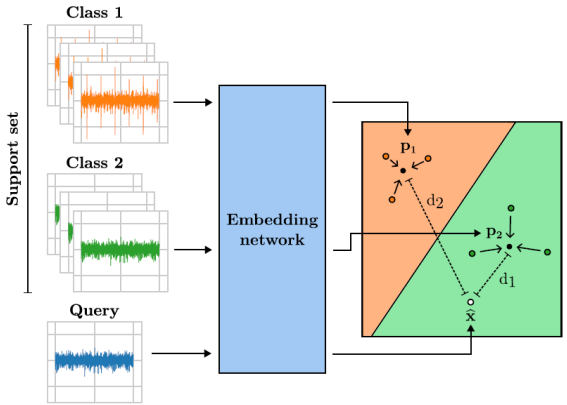
Methods for full cycle electric drive design:
control – drive – electric motor – mechanics – process

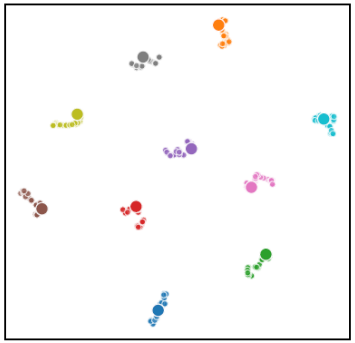
- Typically design work done in silos
- Approach based on linearized equivalent circuit models → fast, enables design space exploration
- Assessment of torsional instability risk
- Ongoing simulation and experimental validation together with VTT and Aalto electric drives



Prototypical networks and few-shot learning for condition monitoring

- Condition monitoring with very limited amount of labeled data
- Analogous to human learn-to-learn
- Training in simulation / lab, operation in field





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