**1 Condition Failure Monitoring - Algorithm Improvement and Failure Prediction Using AI and Machine Learning**

* Predict failure and UUT response based on already measured data
* Use of different AI and Machine Learning techniques
  + - Neural Net
    - Support Vector Machine
    - Hidden Markov Model
    - etc....
* Comparison of different prediction models

6 MonthsMaster Thesis  
  
**2 Condition Failure Monitoring - Simulation of Testbed Failures and its Response on Measurement Signals**

* Setting up 1D/3D model of simplified testbed in AMESIM/EXCITE
* Failure definition
  + - Isolation
    - Bearings
    - magnets
* Failure modelling used to simulate effects dependant on their heaviness
* CFM signal post processing of simulation results taking a look how CFM will detect failure

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**3 Testbed Simulation - Controller Implementation and its Effects on Measurement Response**

* Setting up 1D Model of simplified testbed(s) in AMESIM
* including controllers on input and output side similar like real TB setup
* simulate with already used controller settings UUT behavior and response
* Optimize controller paramter strategy including different loadpoints and load profiles
* Workflow creation for controller parameter settings

3 MonthsBachelor Thesis  
  
**4 Methodology of structure borne noise to airborne noise conversion considering acoustic radiation efficiency**

* improve airborne noise calculation based on sound power
* correlation to excite acoustics simulation from various projects

3 MonthBachelor Thesis  
  
**5 Relation between gear microgeometry modification and transmission error torque sweep function + contact pattern**

How does the TE vs. torque function and contact pattern looks like due to different microgeometry modifications.

* Investigations on ideal case (only tooth stiffness).
* Investigation on real model: considering tooth, shaft, bearing, housing stiffness.
* For both spur and helical gear.

Outcome: A know-how 'database', if the have to optimize TE for a specific torque level, to know what is the effect of which microgeometry modification (also for contact pattern)

6 MonthMaster

**6 Excite SBN results reproduction with Abaqus frequency domain solver + damping model development (emotor with higher damping, damping pads)**

* There is a limitation in Excite regarding to damping models.
* In Abaqus frequency domain solver there is multiple solution to define Rayleigh or hysteresis damping for each component of housing structure.
* Task is to find a way how to reproduce Excite results with Abaqus.
* Then compare results with detailed damping modelling.

6 MonthsMasterx

**7 Condition Failure Monitoring - Correlation of UUT & testbed failures and their response on measurement signals on the high speed testbed**

Using the high speed testbed for investigating the measurement signal response in case of purposely created/modelled UUT & testbed failures.

* Making a test case list about the purposely created failures/damages (gear damage, bearing damage, imbalance of shafts etc.)
* Supporting the execution of the test cases at the testbed
* Measurement post-processing and correlation to CFM results in order to see the response
* Added benefit/topic:
  + Correlation of contact pattern results and any other 1D simulation results in case of purposely created operational cases → at least additional 3 months

6 MonthsMaster Thesis  
  
**8 Controller parameter study and investigation its signal response on the high speed testbed**

Using the high speed testbed for investigating the measurement signal response in case of a controller parameter study.

* Set up a controller parameter study
* Supporting the execution of the test cases at the testbed
* Measurement post-processing and correlation to CFM results in order to see the response
* Correlation to controller parameter simulation (linked to #3 - Thesis idea)

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**9 Measurement and processing of  torque ripple results**

Study effects playing role in ripple measurements

Create tool or simulation model for evaluation and pre-calculation of effects taking into account mech. setup (clutches, dyno, position sensor, flywheel)

Cooperation with testbed design

* Noise factors of cogging torque, torque ripple measurements: NVH, shaft connections, dyno etc.
* Optimization of a certain shaft connection and dyno type.
* Investigation of various shaft connections → Possibilities, effects

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**10 Test bed design for >= 10 kW servo applications**

* Check applications which could be measured on a single test bed (same shafts, bearings, dyno etc) eg.: 2 WP, aviation (drone), eBike …
* Identify differences in requirements to usual eAxles
* Create test bed design

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**11 Inverter testing on EDU system level:**

* Evaluation of test cases that can be executed
* High flexible usage of B2B test environments with climatic chambers
* HV / LV safety on system level (LV123 / LV124-1)
* Possible strategy:
  + Understanding of various standards for various markets (EU, USA, China etc.) → Cooperation with DVP
  + What's next? Decide based on outcomes of customer projects

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**12 High accurate assessment of efficiency distribution in an electrified Driveline (e.g. DHT, EDU)**

* Test envirmonments and instrumentation (Piezo, magnetostrictive transducers, ...)
* Measurement uncertainty of instrumentation (see also subject 1)
* Correlation to efficiency simulation tool

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