

Digital Twinning of Mechatronic Systems for Control and Fault Diagnosis



Research Website

Dr Mark Ng SMIEEE

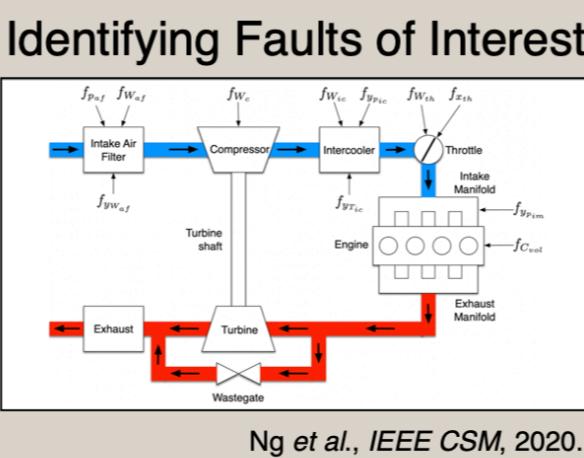
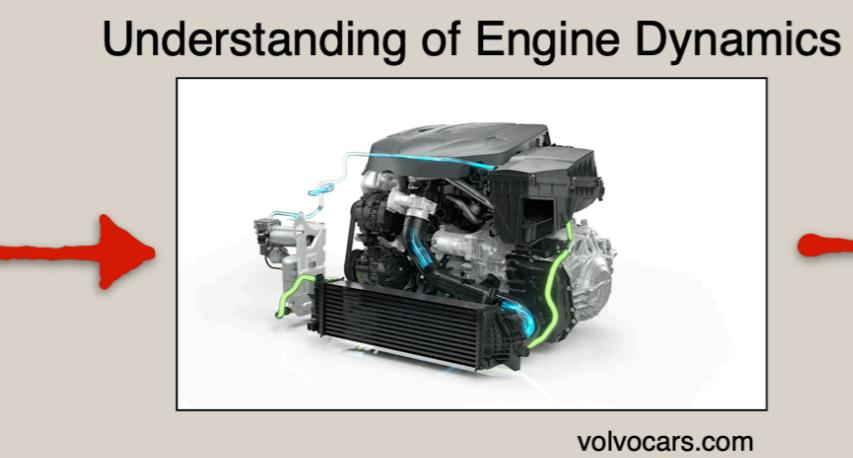
Reader, School of Engineering

Vice-Chair, IEEE Control Systems Society (UK & Ireland Chapter)

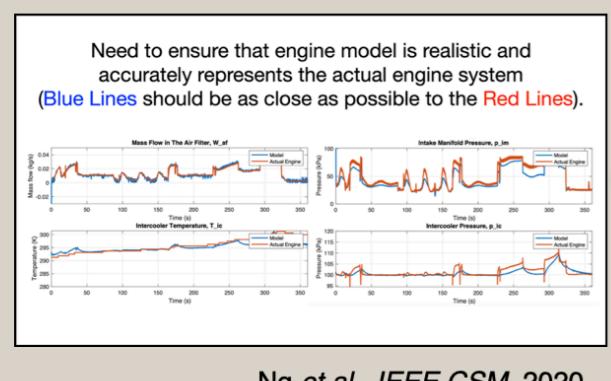
ILN+ Researcher in Residence with Digital Catapult



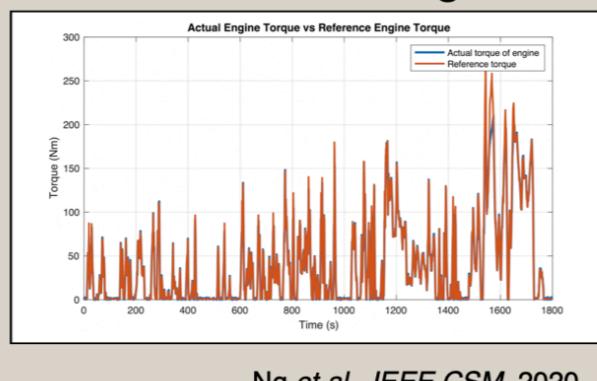
Digital Twin of an Automotive Engine System



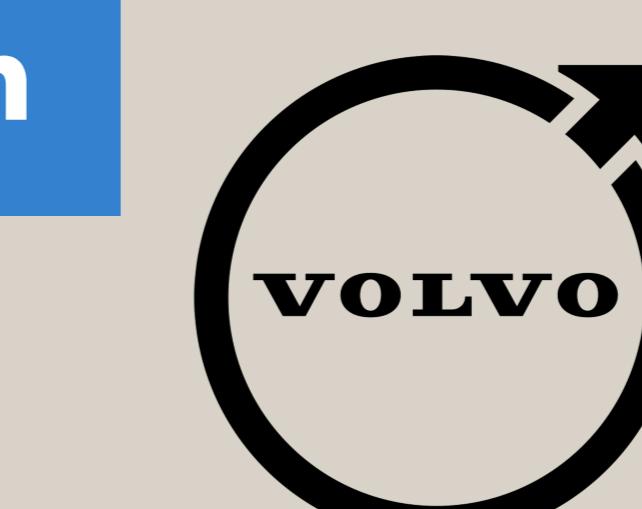
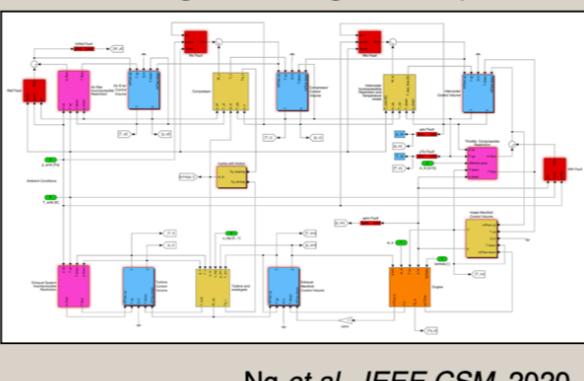
Verification of Engine Model and Controller Design



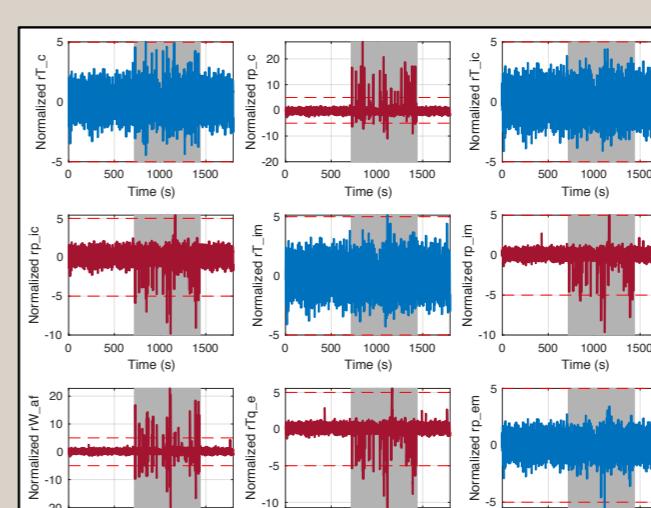
Controller Design



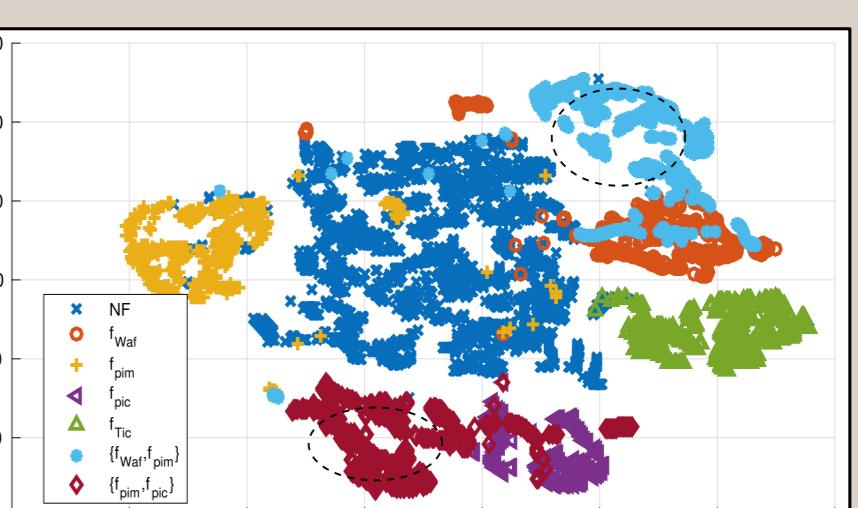
Modeling of Engine System



MONASH University

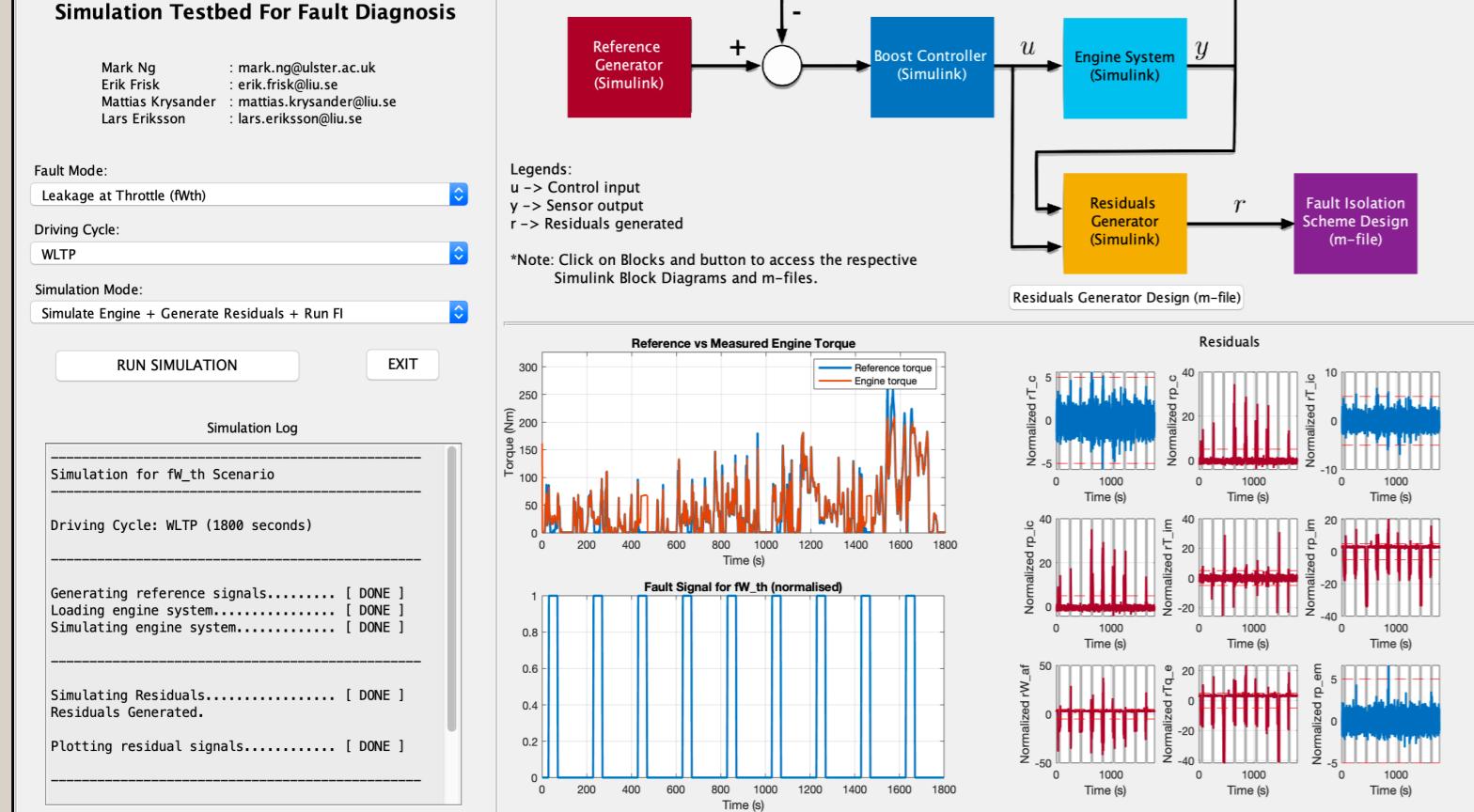


Residuals Analysis

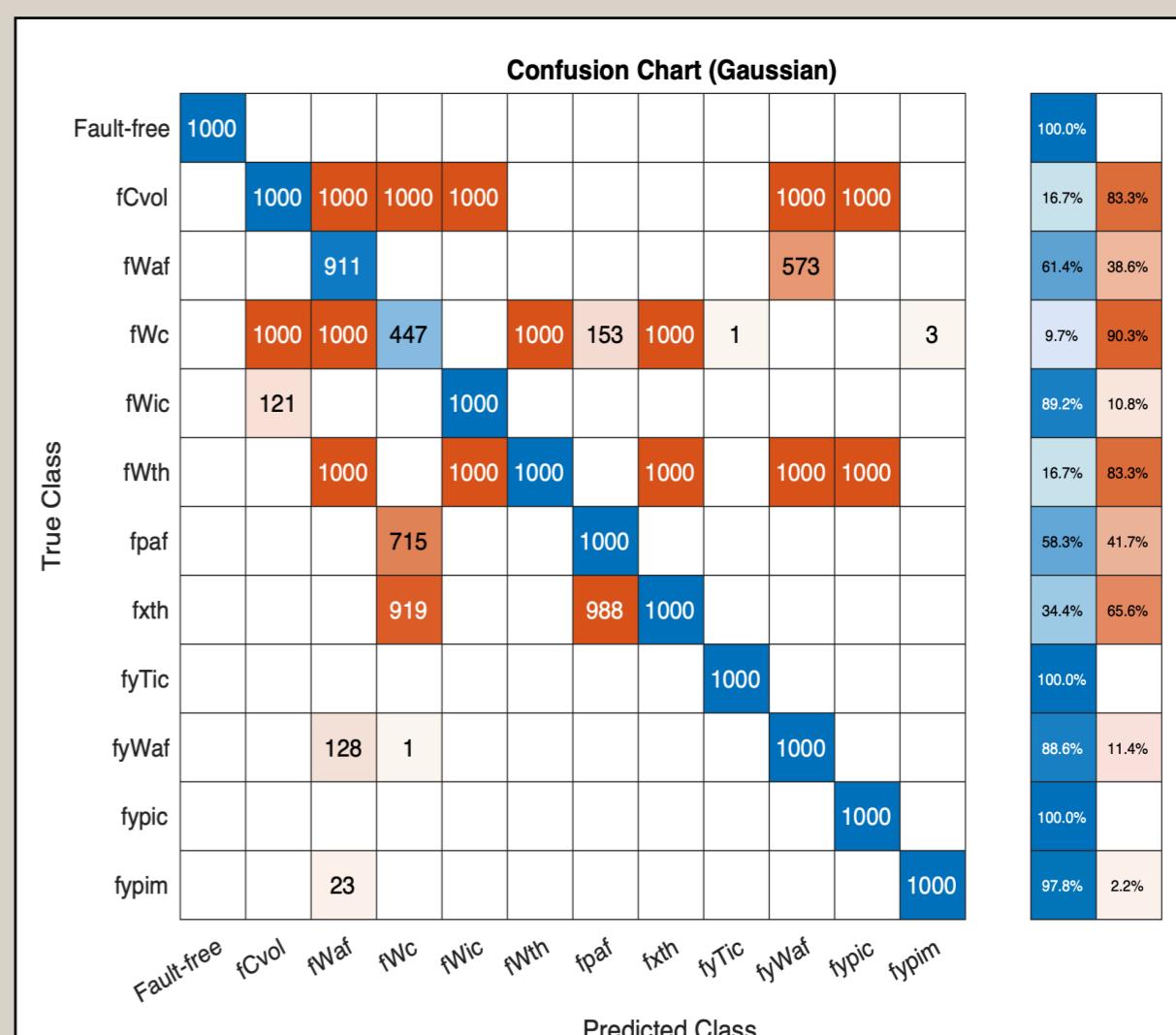


Multidimensional Data Analysis

Turbocharged Petrol Engine System: Simulation Tested For Fault Diagnosis



Simulation GUI and Telemetry Visualizations



Classification and Diagnosis



GitHub

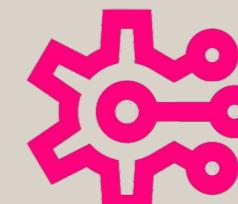


IEEE CSM Paper

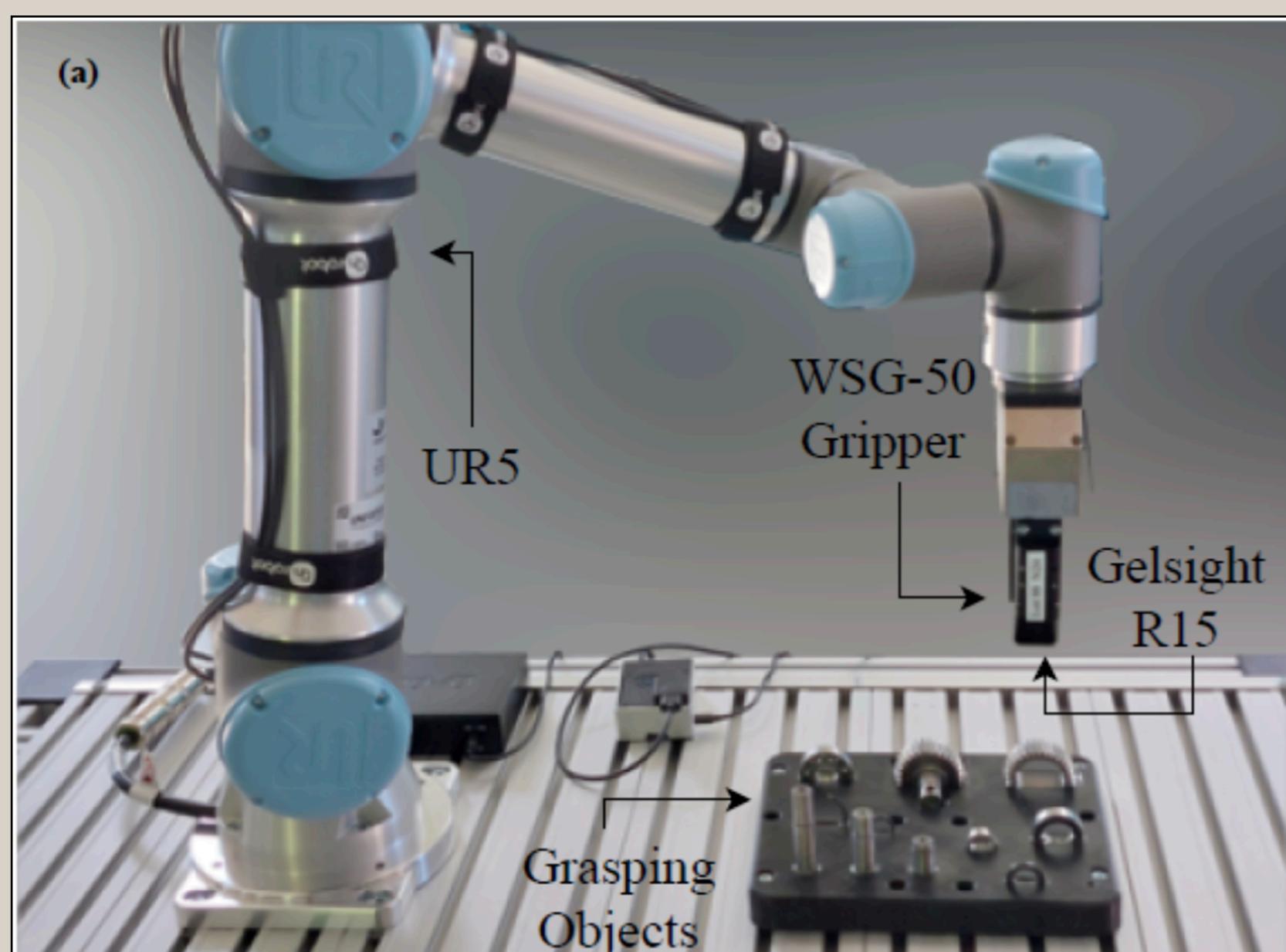
Digital Shadow of a Manufacturing System



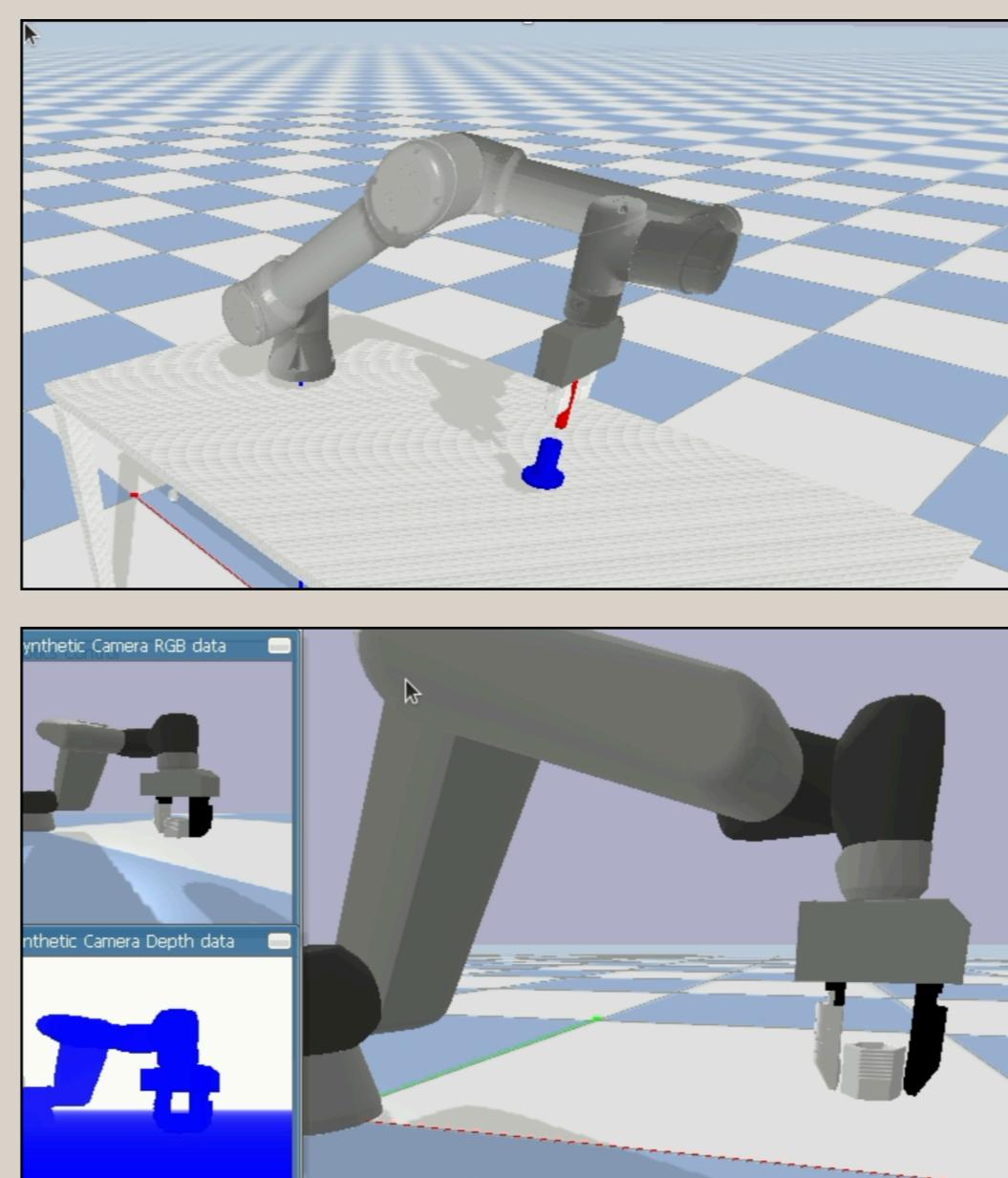
Technische Hochschule Augsburg



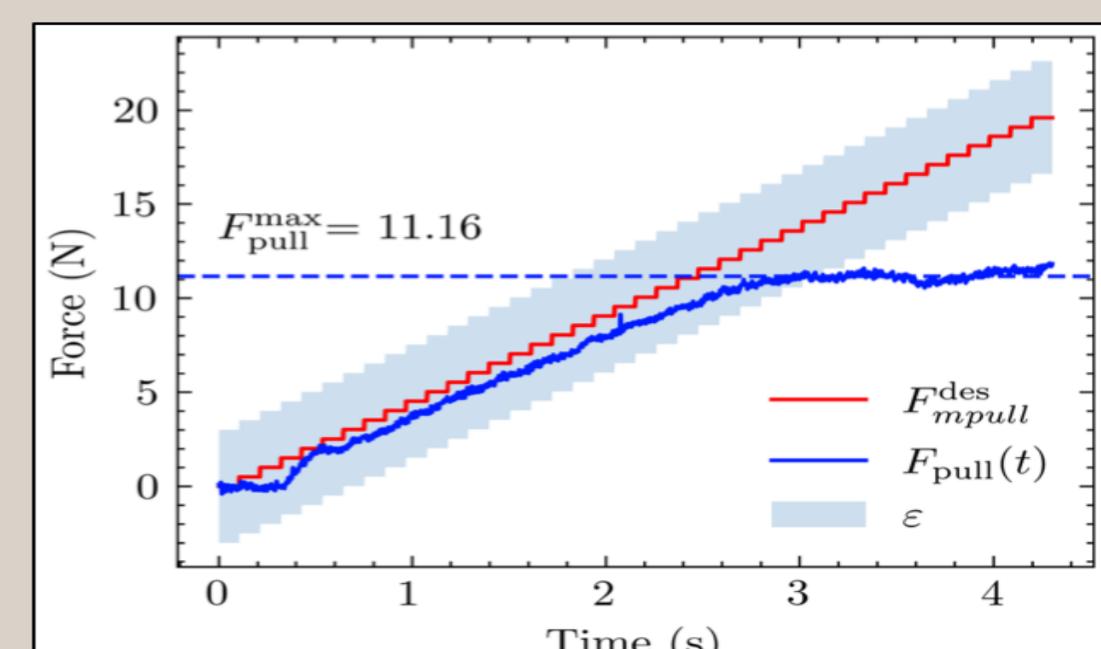
TTZ Nördlingen Flexible Automation



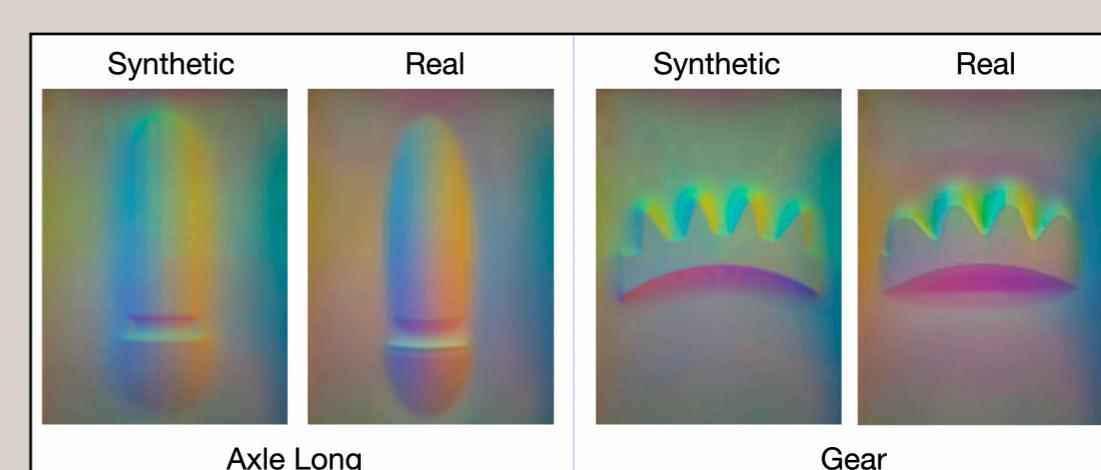
Actual Physical System



Digital Shadow



Dynamics Prediction



Generation of Synthetic Data



Paper #1



Paper #2

Other Collaborators and Partners

CATAPULT
Digital

IEEE
Control Systems
Society™

elite

NIACE
Advanced Composites
and Engineering

ARQ
RELIABILITY



NEURAL ENGINEERING
DATA CONSORTIUM



Northumbria
University
NEWCASTLE

Selected Key Publications

- “Predicting Maximum Permitted Process Forces for Object Grasping and Manipulation Using a Deep Learning Regression Model,” *IEEE CCTA*, 2024.
- “Learning to Predict Grip Quality from Simulation: Establishing a Digital Twin to Generate Simulated Data for a Grip Stability Metric,” *arXiv preprint arXiv:2302.03504*, 2023.
- “A Realistic Simulation Testbed of a Turbocharged Spark-Ignited Engine System: A Platform for the Evaluation of Fault Diagnosis Algorithms and Strategies,” *IEEE Control Systems Magazine*, 2020.
- “Design and Selection of Additional Residuals to Enhance Fault Isolation of a Turbocharged Spark Ignited Engine System,” *IEEE CoDIT*, 2020.
- “Combining model-based diagnosis and data-driven anomaly classifiers for fault isolation,” *Control Engineering Practice*, 2018.
- “Real-Time Closed-Loop Color Control of a Multi-Channel Luminaire Using Sensors Onboard a Mobile Device,” *IEEE Access*, 2018.
- “A Sliding Mode Observer for Infinitely Unobservable Descriptor Systems,” *IEEE Transactions on Automatic Control*, 2017.
- “Development of a prototype smart home intelligent lighting control architecture using sensors onboard a mobile computing system,” *Energy and Buildings*, 2017.
- “A combined diagnosis system design using model-based and data-driven methods,” *IEEE SysTol*, 2016.
- K. Y. Ng, “Design and Development of A Simulation Environment and A Fault Isolation Scheme on A Volvo VEP4 MP Engine,” *Research and Development Centre, Volvo Car Corporation, Gothenburg, Sweden, Tech. Rep.*, 2015.