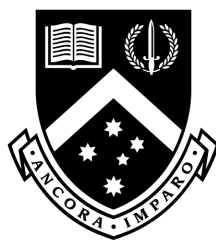
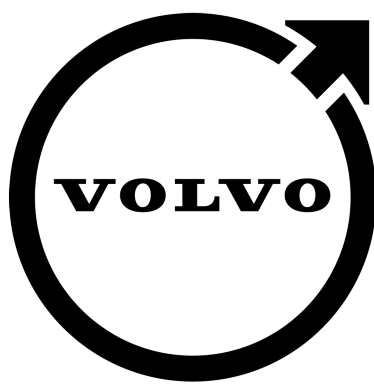


Digital Twin of a Turbocharged Spark-Ignited Engine System for Control and Fault Diagnosis

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Physical Automotive Vehicle



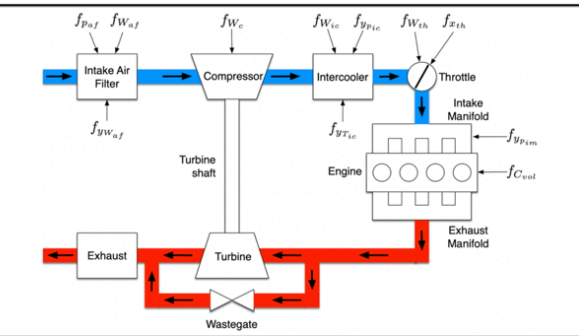
volvocars.com

Understanding of Engine Dynamics



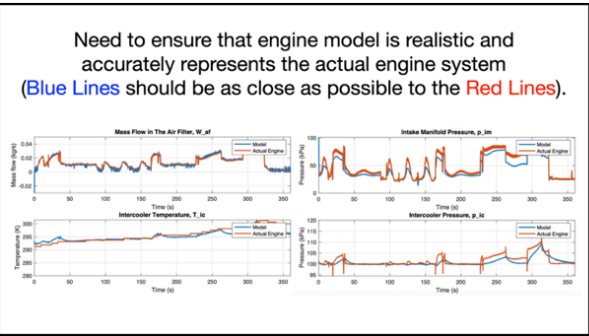
volvocars.com

Identifying Faults of Interest



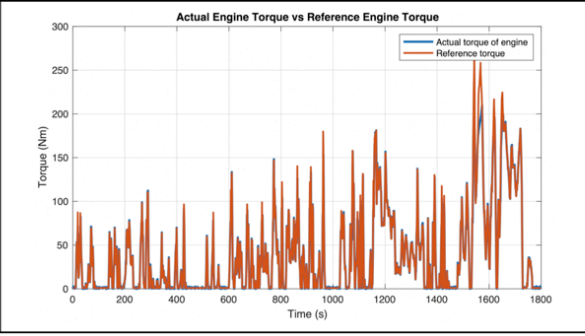
Ng et al., IEEE CSM, 2020.

Verification of Engine Model and Controller Design



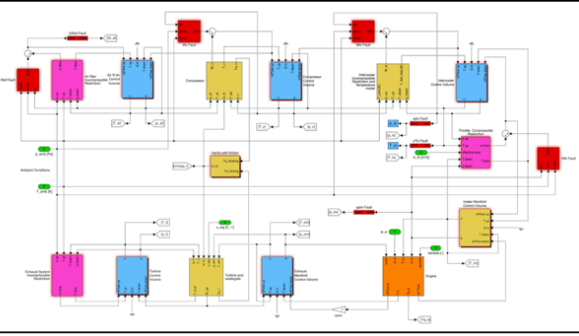
Ng et al., IEEE CSM, 2020.

Controller Design

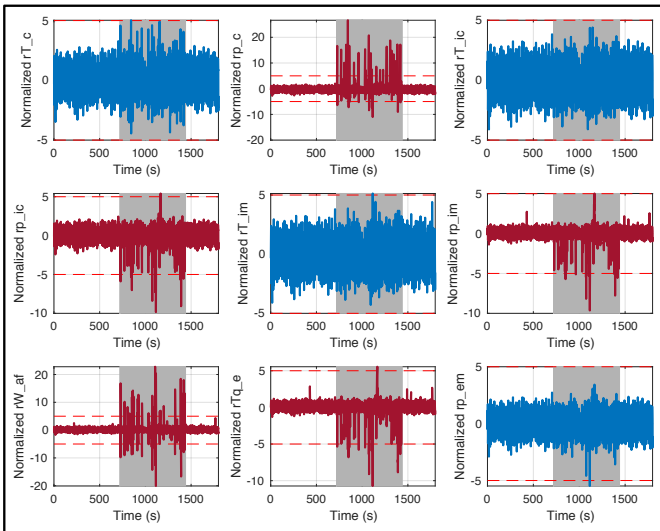


Ng et al., IEEE CSM, 2020.

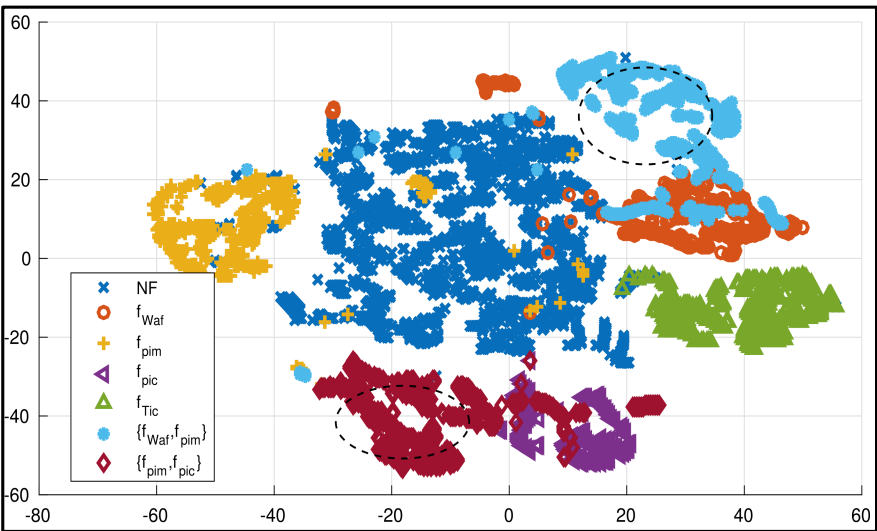
Modeling of Engine System



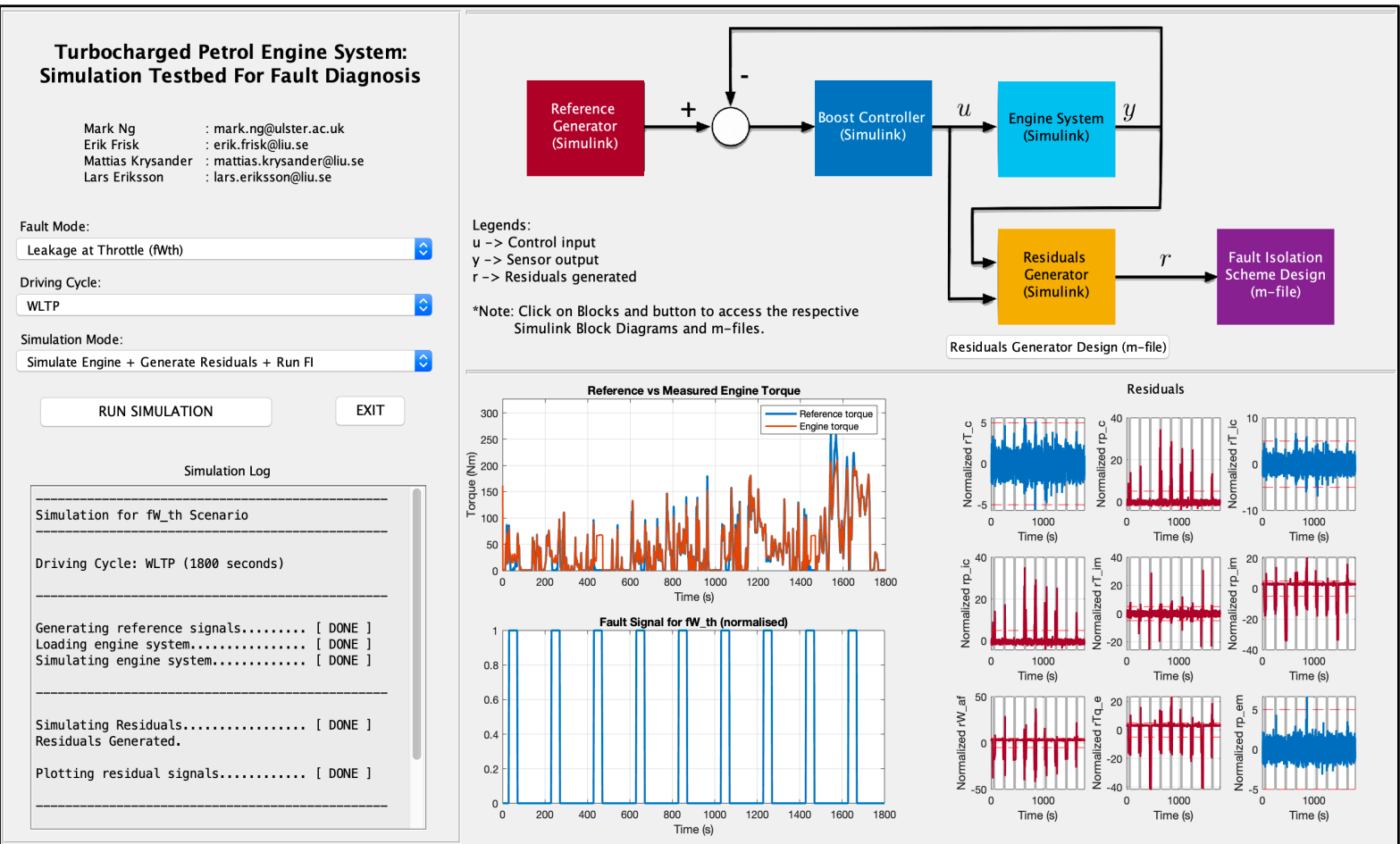
Ng et al., IEEE CSM, 2020.



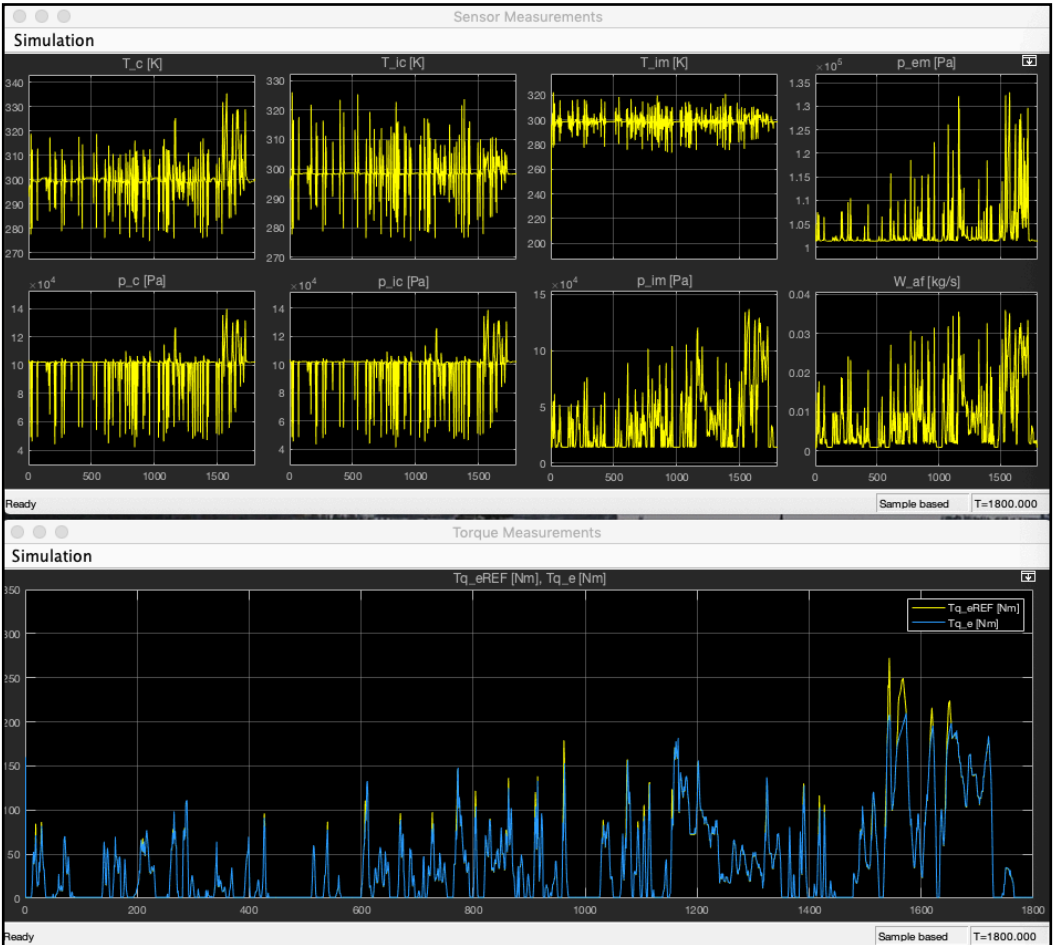
Residuals Analysis



Multidimensional Data Analysis



Simulation GUI and Telemetry Visualizations



Confusion Chart (Gaussian)												
True Class	Fault-free	fCvol	fWaf	fWc	fWic	fWth	fpaf	fxth	fyTic	fyWaf	fypic	fypim
	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000
	fCvol	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000
	fWaf	911	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000
	fWc	1000	1000	447	1000	153	1000	1	1000	1000	1000	1000
	fWic	121	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000
	fWth	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000
	fpaf	715	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000
	fxth	919	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000
	fyTic	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000
	fyWaf	128	1	1000	1000	1000	1000	1000	1000	1000	1000	1000
	fypic	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000
	fypim	23	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000
Predicted Class												

Classification and Diagnosis



GitHub



IEEE CSM Paper