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A Comparative Study of White-Box Modeling Techniques for Digital Twin Development of Traction Motors

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Digital Twins at a Glance

Application Purposes

- Realistic and efficient simulation
- Scenario generation
- System optimization
- Condition monitoring
- Predictive maintenance and lifetime estimation

Application Areas

Related Research

- Big data analytics
- AI
- Estimation theory
- Modeling and simulation
- Data security
- Communication

Methodology

Definition of the purpose of the DT

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Selection of suitable modeling approaches for all subdomains

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Extension of the model details w.r.t. the application

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Generating experimental data from several traction motors

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Data classification and process

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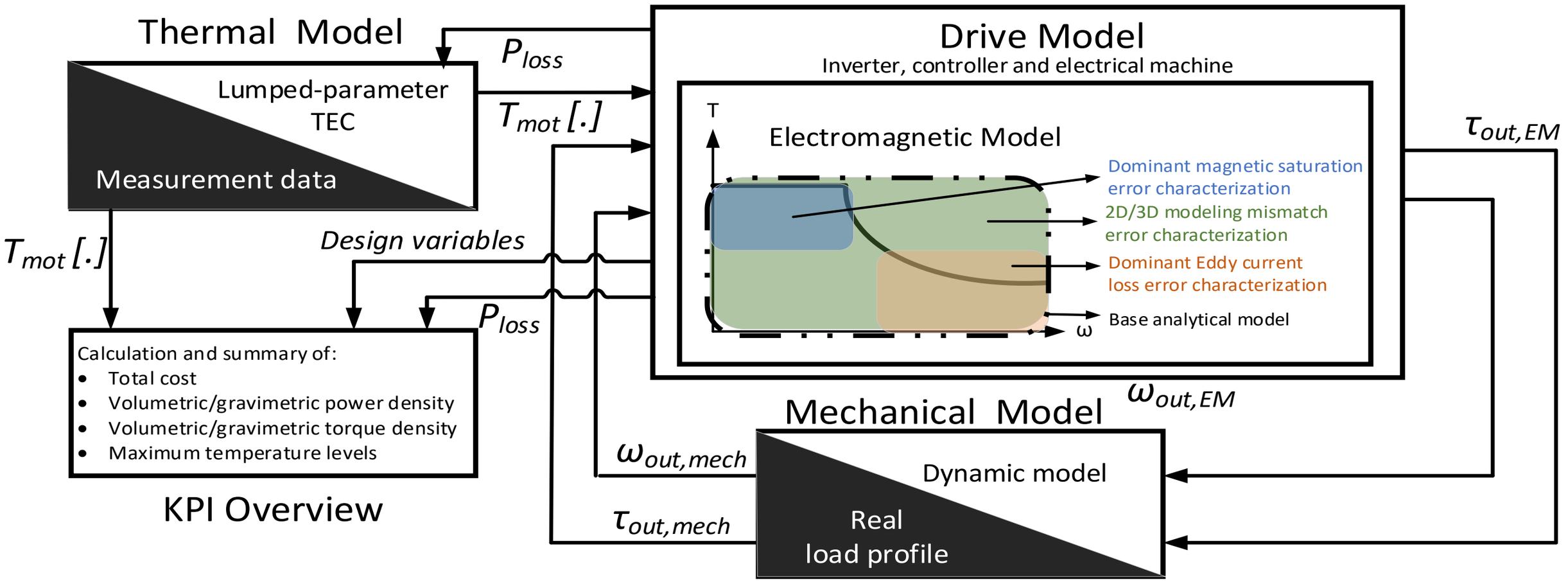
Merging the multiphysics simulation with the real data

Grey-Box Model Structure for Traction Motors



Comparison of the Modeling Methods for the White-Box Model

	Model / Criterion	FS	MM	MEC	TCM	AC	CC	BEM	FEM	FS+ MEC	TCM + SC
Model Dev.	Complexity	+1	+1	+1	+1	+1	+1	-1	-1	-1	-1
	Power Scalability	+1	+1	+1	+1	+1	+1	0	0	+1	+1
	Model Flexibility	-1	-1	0	0	-1	-1	-1	-1	0	0
Model Operation	Material Dep.	+1	-1	+1	+1	-1	-1	+1	+1	+1	+1
	Temp. Dep.	-1	-1	+1	+1	-1	-1	-1	+1	+1	+1
	Model Accuracy	0	0	-1	0	0	0	+1	+1	+1	+1
	Evaluation Speed	+1	+1	+1	+1	+1	+1	-1	-1	0	0
	Co-sim. Req.	+1	+1	+1	0	+1	+1	0	0	+1	0
Total Points		+3	+1	+5	+5	+1	+1	-2	0	+4	+3