

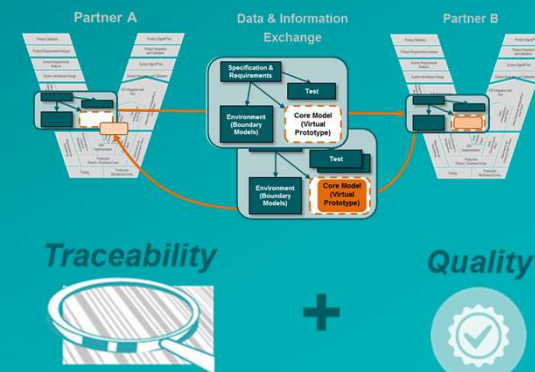
Workshop “Traceability of Simulation Tasks”

DC – Motor Mild Hybrid

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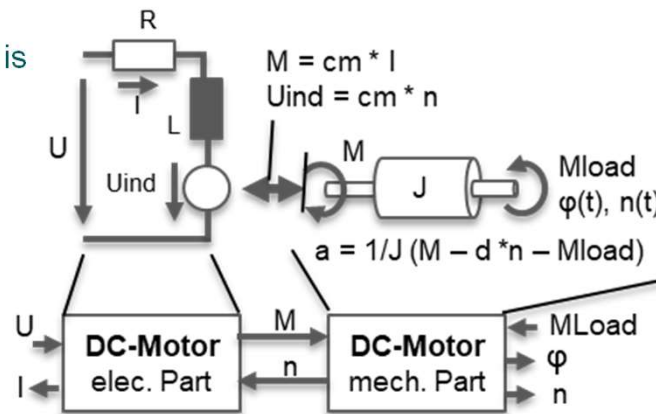
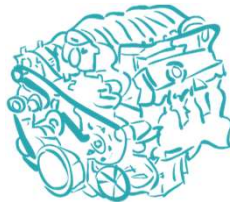


“Traceability and proof of quality of Simulation Tasks”

Example: DC-motor

Engineering/Simulation Task

- Pre-selection of a DC-motor for a mild hybrid application (drive Unit)
- DC-Motor has to accelerate against a Load $M_{Load} = 1 \text{ Nm}$ in 1s from 0 to 1000 rad/s. Voltage $U = 48 \text{ V}$
- A simple simulation model which contains the basic physical effect is used
- Neglected effects
 - Commutation effects (losses are considered in R)
 - Eddy currents
 - Friction (should be added to M_{Load})



In / Outputs	Name	Unit	Format	Comment
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Electrical Part DC Motor Model

Supply Voltage	U	V	Float32	
Current	I	A	Float32	
Motor Torque	M	Nm	Float32	

Mechanical Part DC Motor Model

Acceleration	a	Rad/s ²	Float32	internal
Rotation speed	n	Rad/s	Float32	
angle	φ	Rad	Float32	
Load Torque	Mload	Nm	Float32	

Parameters	Name	Unit	Format	default Value
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Electrical Part DC Motor Model

Resistance	R	Ohm	Float32	1
Inductance	L	mH	Float32	1
motor constant	c_m	Nm/A	Float32	0,2

Mechanical Part DC Motor Model

Inertia	J	Kgm ²	Float32	0,002
Damping	d	Nm/rad	Float32	0.001
Friction	Mfr	Nm	Float32	0,01

“Traceability and proof of quality of Simulation Tasks”

Example: Engineering Task DC-motor

Project Name
Mild Hybrid Variant AAA-55
Project Number
P987658
Version
2
Prj Leader
J. Miller
Description of project
Developing of variant of a mild hybrid based on platform DDC
SubTask
Pre-selection of a DC-motor for a mild hybrid application
Verify if DC-Motor part number XY12346 can be used
Requirements
DC-Motor part number XY12346 has to accelerate against a Load
MLoad = 1 Nm in 1s from 0 to 1000 rad/s
Simplified requirements, derived from mild hybrid req.
Simplification: Friction is added to Mload
Boundary Conditions
U = 48 V



“Traceability and proof of quality of Simulation Tasks”

Example: Engineering Task DC-motor

Part	DC-Motor			
Part Number	XY12346			
Organisation	KKKK			
Date	05 Dec 2015			
* additional measurement conditions see appendix cdefg				
Parameter	Value	Unit	Tolerances	measurement conditions*
R (Resistance)	0,2	Ohm	-5 up +10%	20 degree, after 20 min operation
R (Resistance)	0,22	Ohm	-5 up +10%	70 degree, after 20 min operation
R (Resistance)	0,24	Ohm	-10 up +20%	20 degree, new, 0 min operation
L (Inductance)	1,0	mH	-5 up +10%	20 degree
cm (motor constant)	0,03	Nm/A	-5 up +10%	20 degree
J (Inertia)	0,002	Kgm2	-2 up +2%	20 degree
d (Damping)	0,001	Nm/rad	-10 up +20%	20 degree
Mfr-Br (Friction Brushes)	0,007	Nm	-10 up +20%	20 degree, after 20 min operation
Mfr-Br (Friction Brushes)	0,005	Nm	-10 up +20%	20 degree, new, 0 min operation
Mfr-Be (Friction Bearing)	0,003	Nm	-10 up +20%	20 degree
Length motor	0,1	m	-2 up +2%	20 degree
Diameter motor	4	cm	-2 up +2%	20 degree
Weight motor	0,3	kg	-2 up +2%	20 degree
Length rotor	7	cm	-2 up +2%	20 degree
Diameter rotor	2,5	cm	-2 up +2%	20 degree
Weight rotor	150	g	-2 up +2%	20 degree
Temperature Range	-30 up +90	Degree		
max continuous current	50	A		20 degree
max peak current	100	A		20 degree, duration 5 s, repeat rate 5 min
xxx	xxx	aaa		
yyy	yyy	bbb		
zzz	zzz	ccc		

Artificial values, not corresponding to a real DC-motor

“Traceability and proof of quality of Simulation Tasks”

Example: Data Sheet DC motor

Parameter	Value	Parameter	Value
R (Resistance)	0,2 Ohm	Length motor	0,1 m
L (Inductance)	1 mH	Diameter motor	4 cm
cm (motor constant)	0,03 Nm/A	Weight motor	0,3 kg
J (Inertia)	0,002 Kgm ²	Length rotor	7 cm
d (Damping)	0,001 Nm/rad	Diameter rotor	2,5 cm
Mfr-Br (Friction Brushes)	0,007 Nm	Weight rotor	150 g
Mfr-Be (Friction Bearing)	0,003 Nm	Temperature Range	-30 - +90 Degree
		xxx	xxx
		yyy	yyy
		zzz	zzz



Parameter values are only examples