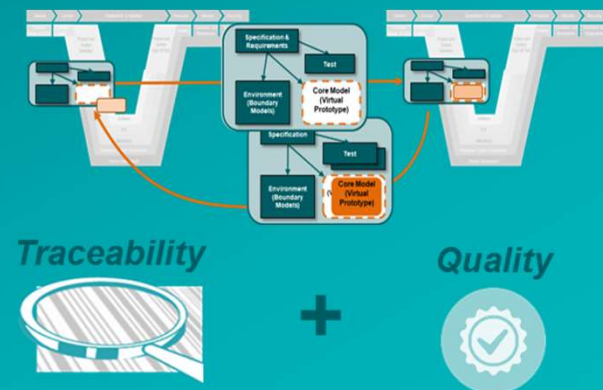


Example “Traceability of Simulation Tasks”

DC – Motor Window Lifter

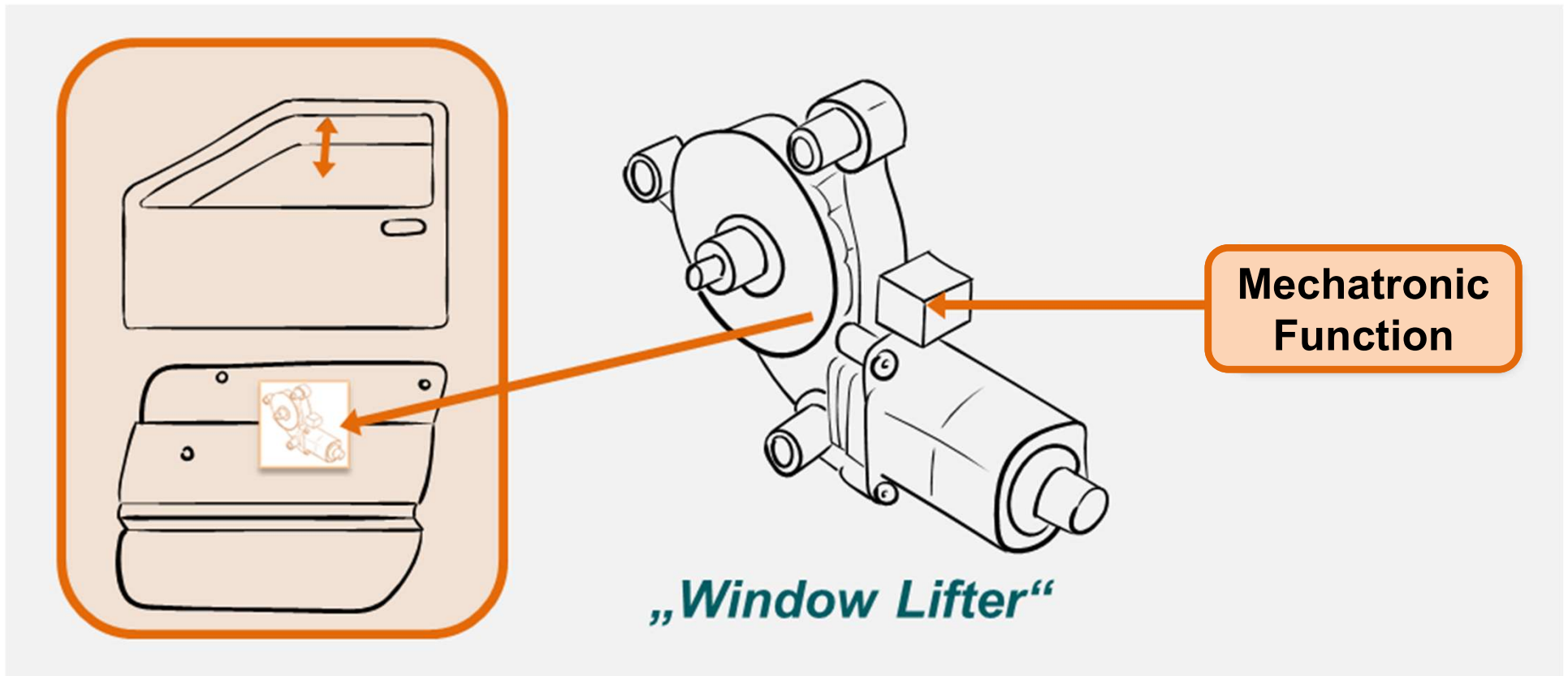
Hans-Martin Heinkel (Robert Bosch GmbH)

March 2024



“Traceability and proof of quality of Simulation Tasks”

Example: Function of Window Lifter

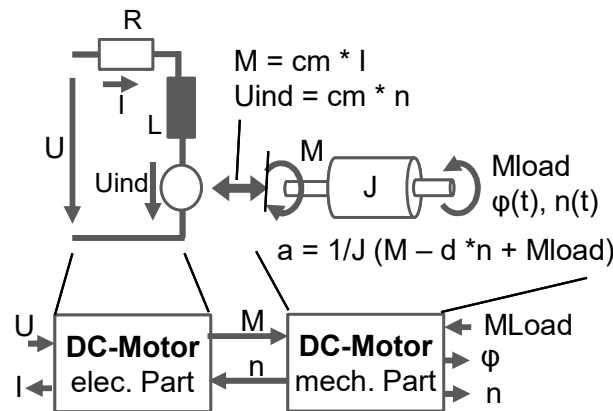
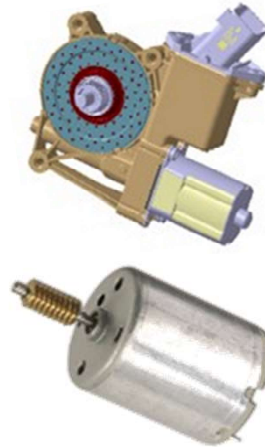


“Traceability and proof of quality of Simulation Tasks”

Example: DC-motor

Engineering/Simulation Task

- Pre-selection of a DC-motor for a window lifter application
- DC-Motor has to accelerate against a Load $M_{Load} = -0.5 \text{ Nm}$ in 0,5 s from 0 to 50 rad/s. Voltage $U = 12 \text{ V}$
- 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})



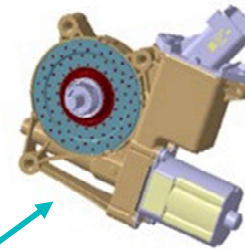
In / Outputs	Name	Unit	Format	Comment
Electrical Part DC Motor Model				
Supply Voltage	U	V	Float32	
Current	I	A	Float32	
Motor Torque	M	Nm	Float32	
Mechanical Part DC Motor Model				
Acceleration	a	Rad/s ²	Float32	internal
Rotation speed	n	Rad/s	Float32	
angle	φ	Rad	Float32	
Load Torque	Mload	Nm	Float32	

Parameters	Name	Unit	Format	default Value
Electrical Part DC Motor Model				
Resistance	R	Ohm	Float32	1
Inductance	L	mH	Float32	1
motor constant	cm	Nm/A	Float32	0,1
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
WindowLifter Variant DDB-34
Project Number
P987654
Version
2
Prj Leader
J. Miller
Description of project
Developing of variant of window lifter based on platform DDB
SubTask
Pre-selection of a DC-motor for a window lifter application
Verify if DC-Motor part number XY12345 can be used
Requirements
DC-Motor part number XY12345 has to accelerate against a Load
$M_{Load} = -0.5 \text{ Nm}$ in 0.5s from 0 to 50 rad/s
Simplified requirements, derived from Window lifter req.
Simplification: Friction is added to M_{load}
Boundary Conditions
$U = 12 \text{ V}$



“Traceability and proof of quality of Simulation Tasks”

Example: Engineering Task DC-motor

Part	DC-Motor	* additional measurement conditions see appendix cdefg		
Part Number	XY12345			
Organisation	KKKK			
Date	05 Dec 2015			
Parameter	Value	Unit	Tolerances	measurement conditions*
R (Resistance)	1	Ohm	-5 up +10%	20 degree, after 20 min operation
R (Resistance)	1,2	Ohm	-5 up +10%	70 degree, after 20 min operation
R (Resistance)	1,3	Ohm	-10 up +20%	20 degree, new, 0 min operation
L (Inductance)	1,0	mH	-5 up +10%	20 degree
cm (motor constant)	0,1	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	7	A		20 degree
max peak current	20	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

