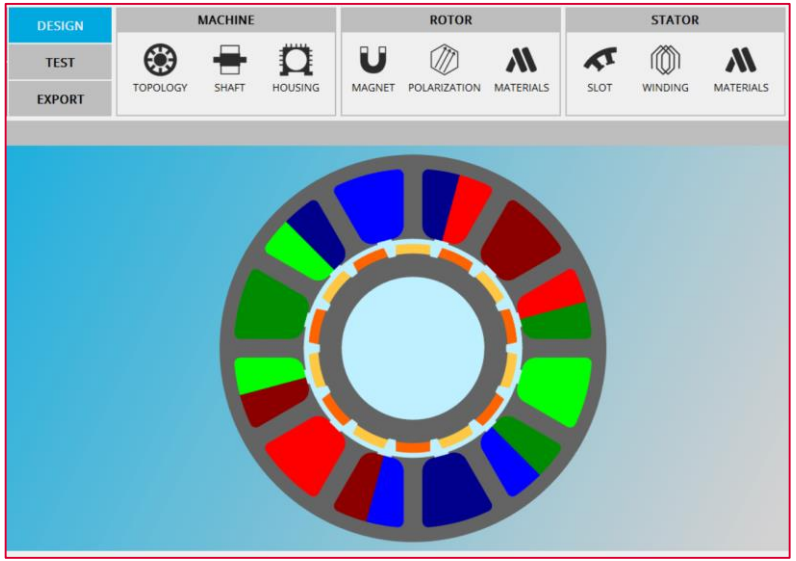
Israel 2019

Altair FluxMotor™



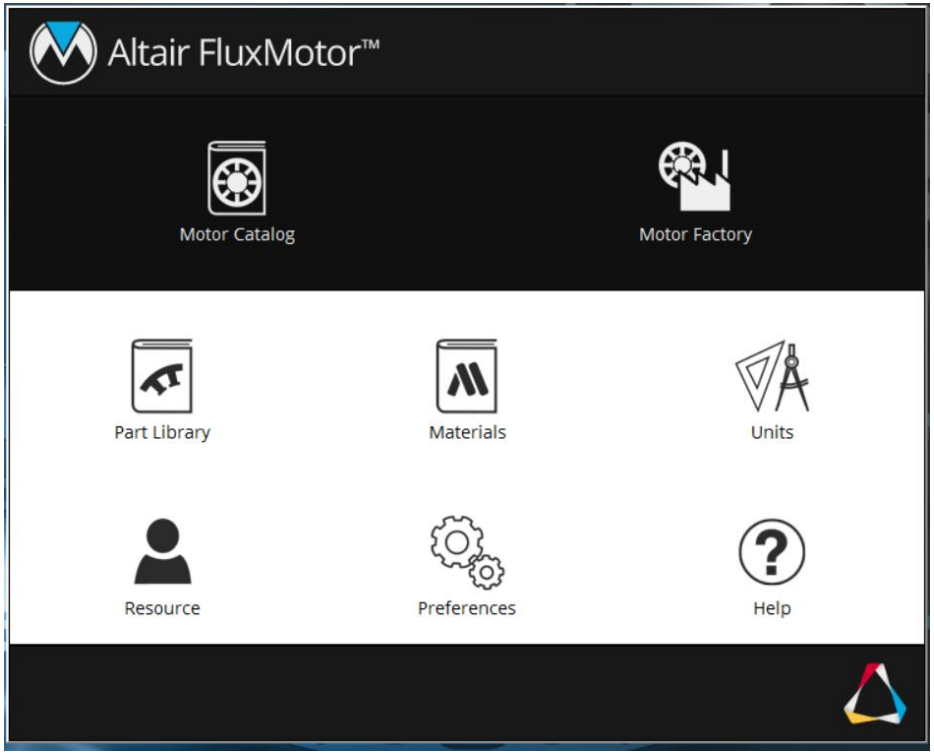
Conceptual design of electric motor

Kobi Ingarm

30.10.2019

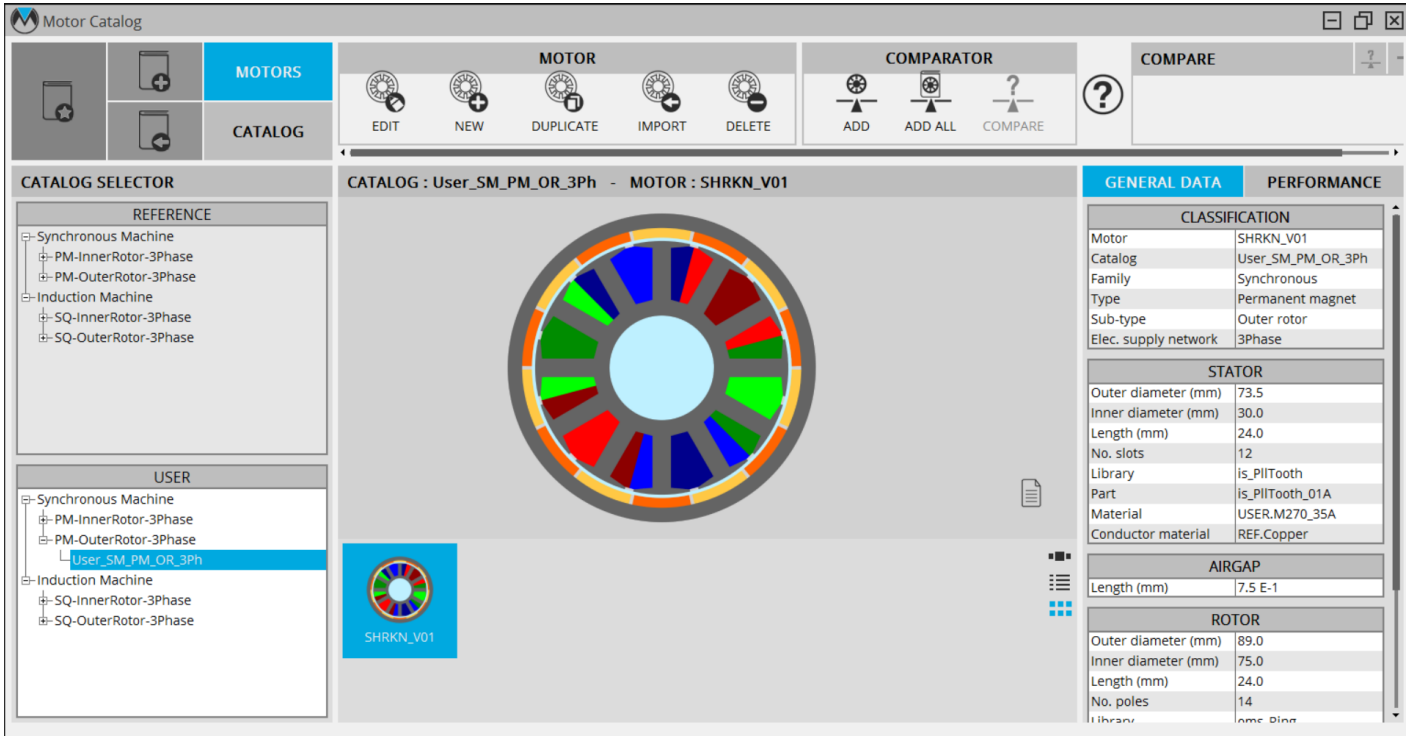
Altair

Flux motor Supervisor



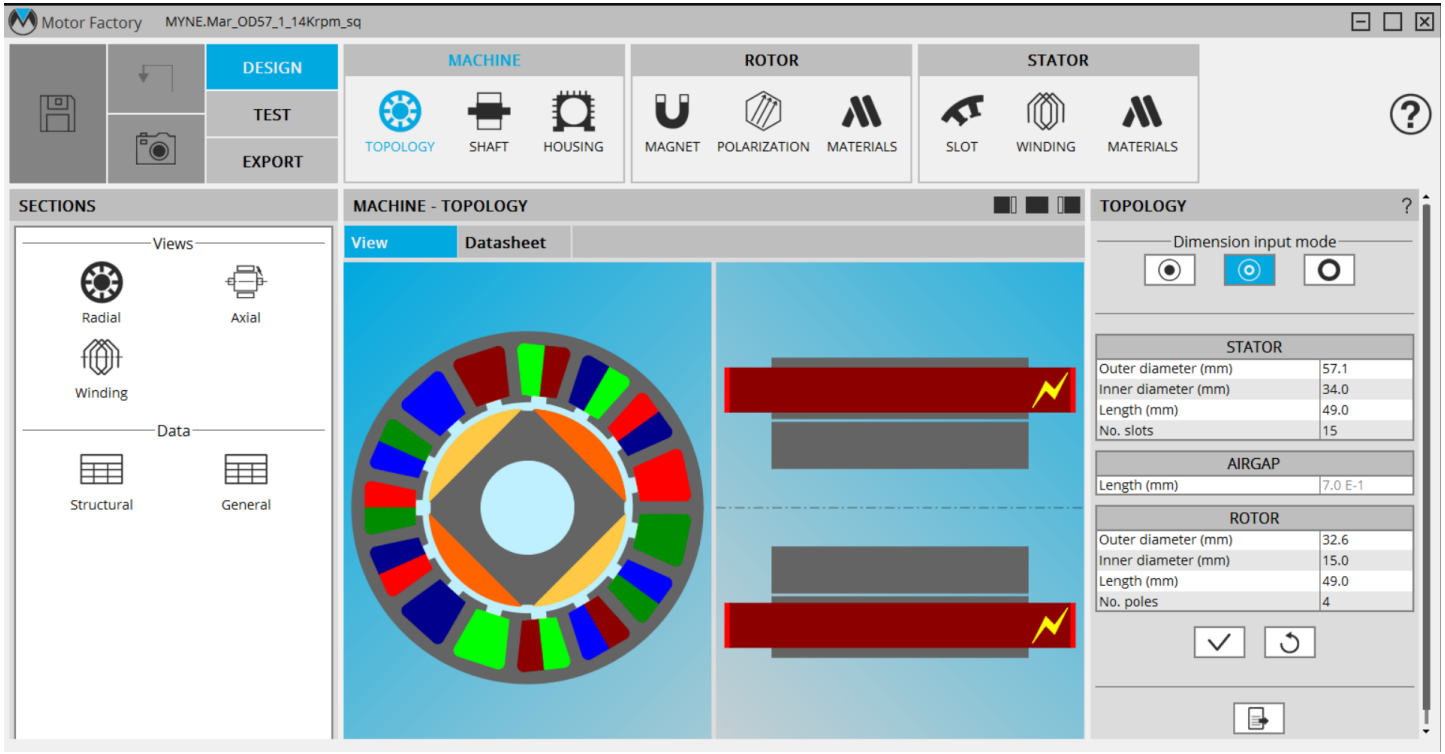
- Built-in and user defined
- Unit control
- Part library
  - Slots
  - Magnets
- Material library
  - Soft magnetic
  - Permanent magnet
  - Steels
  - isolation

Motor Catalog



- Catalog
  - File management
- Motors
  - Types
  - Data
  - Performance
  - Library
  - Comparison

Motor Factory – Design - Machine



- Dimension
  - input
- Views
- Data
- Help
- Housing for thermal

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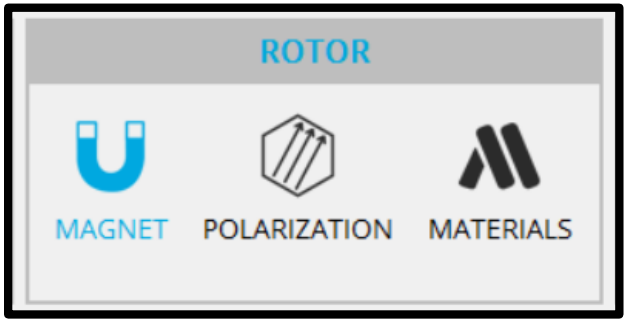
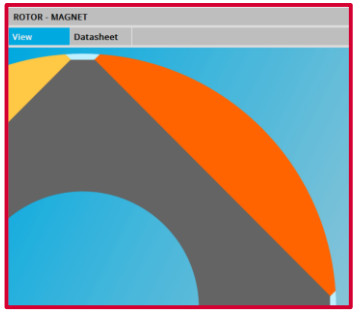
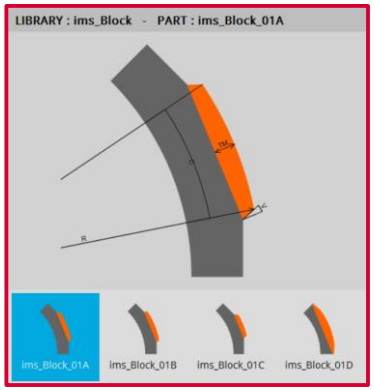
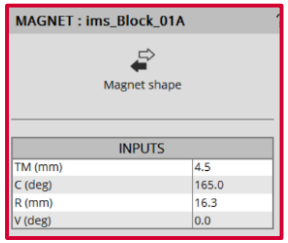
Motor Factory – Design – Rotor - Magnet

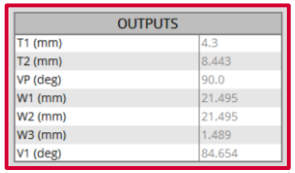




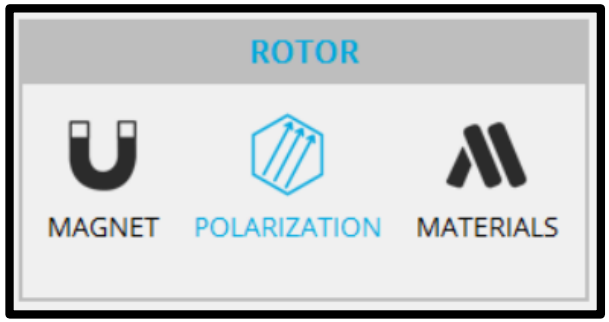
- Magnet shape
  - Dimensions
- Polarization of magnetize
- Rotor materials
  - PM
  - Yoke

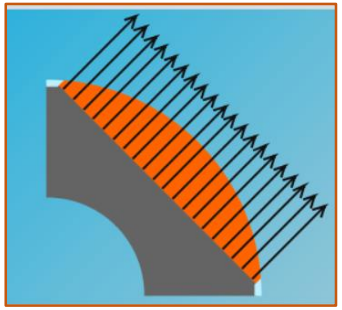


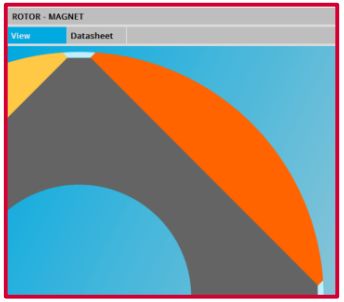




Motor Factory – Design – Rotor - Polarization



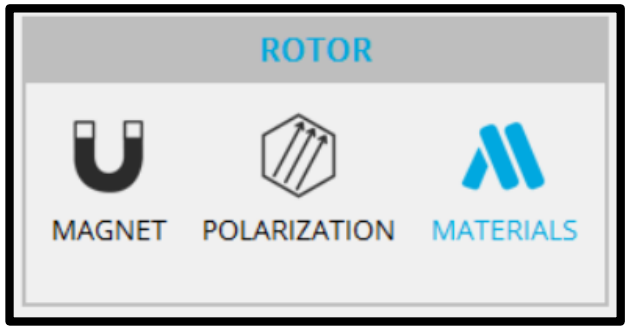




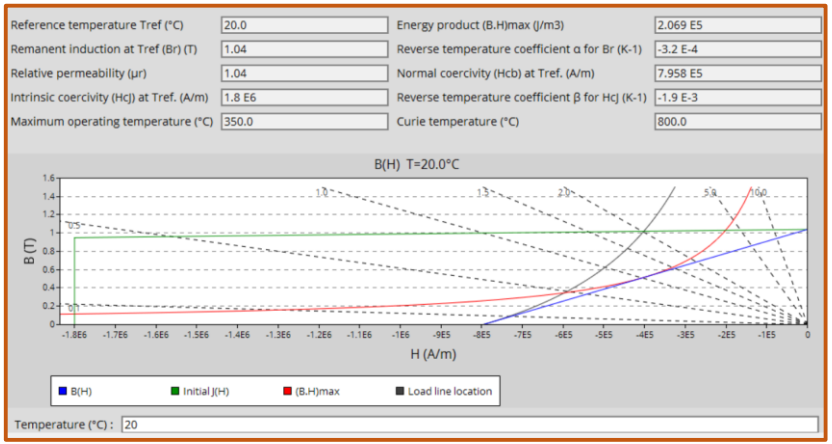
POLARIZATION	
⊟Magnet	
Coord. system	Local
Orientation	Direction
Angle (deg)	90.0

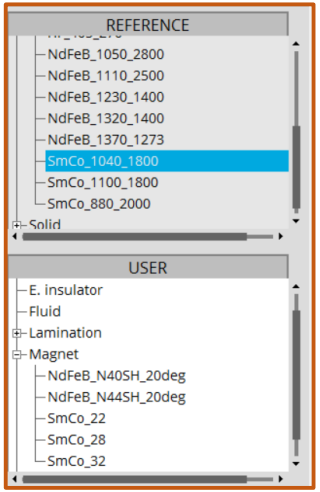
- Magnet shape
  - Dimensions
- Polarization of magnetize
- Rotor materials
  - PM
  - Yoke

Motor Factory – Design – Rotor - Materials



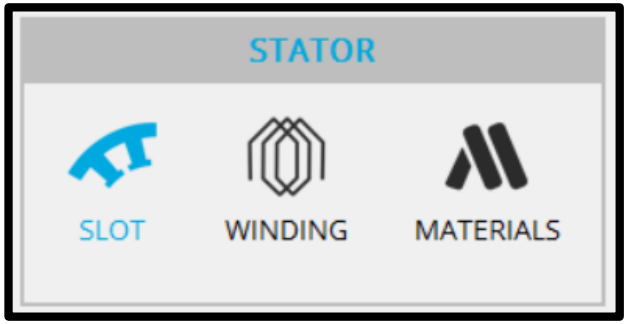
MATERIALS	
Shaft location	REF.Air
⊟Magnets	REF.SmCo_1040_1800
Magnet	REF.SmCo_1040_1800
⊟Magnetic circuit	REF.EN_1_4005
Yoke	
Airgap	REF.Air

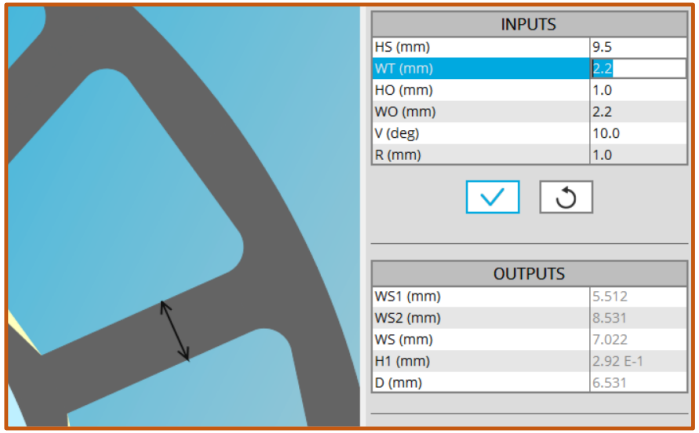


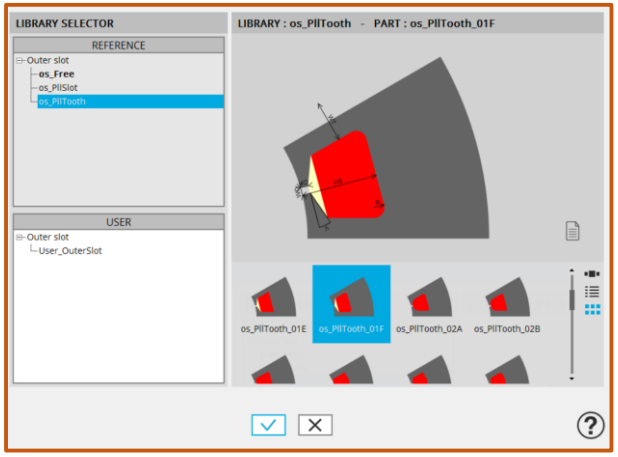


- Magnet shape
  - Dimensions
- Polarization of magnetize
- Rotor materials
  - PM
  - Yoke

Motor Factory – Design – Stator - Slot







- Slot shape
  - Dimensions
- Stator materials
  - Lamination
  - Wire
  - Insulators
- Winding wizard

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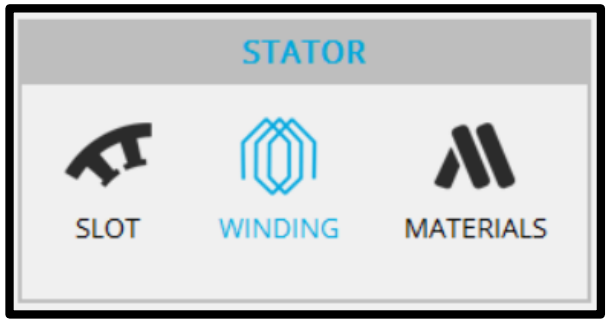
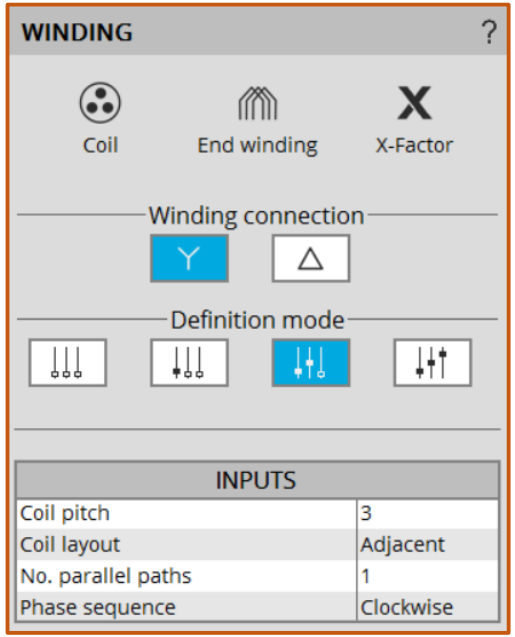
Motor Factory – Design – Stator - Materials

- Slot shape
  - Dimensions
- Stator materials
  - Lamination
  - Wire
  - Insulators
- Winding wizard

MATERIALS	
Airgap	REF.Air
⊞ Magnetic circuit	USER.M270_35A
Coil conductor	REF.Copper
⊞ Insulators	REF.Nomex_130

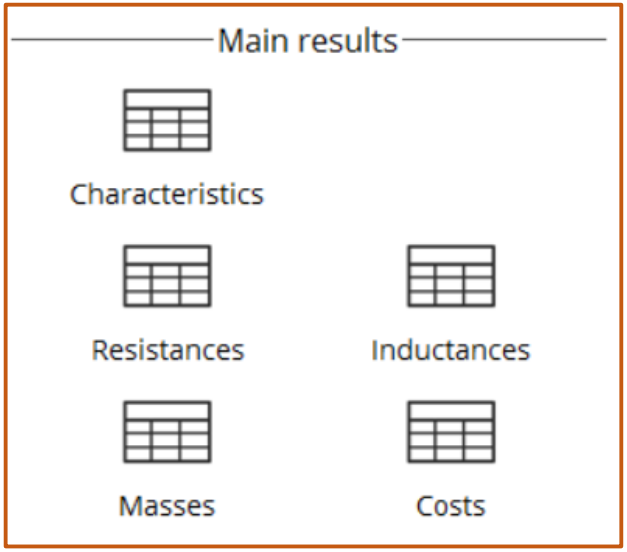
Motor Factory – Design – Stator - Winding

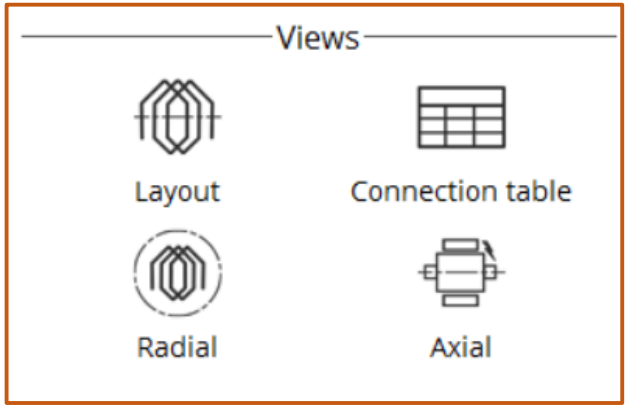


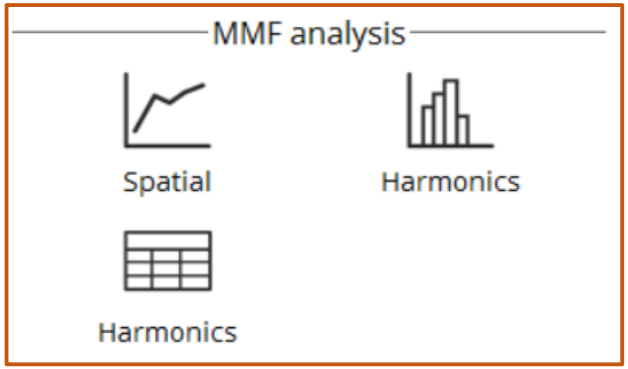


- Slot shape
  - Dimensions
- Stator materials
  - Lamination
  - Wire
  - Insulators
- Winding wizard

Motor Factory – Design – Stator - Winding



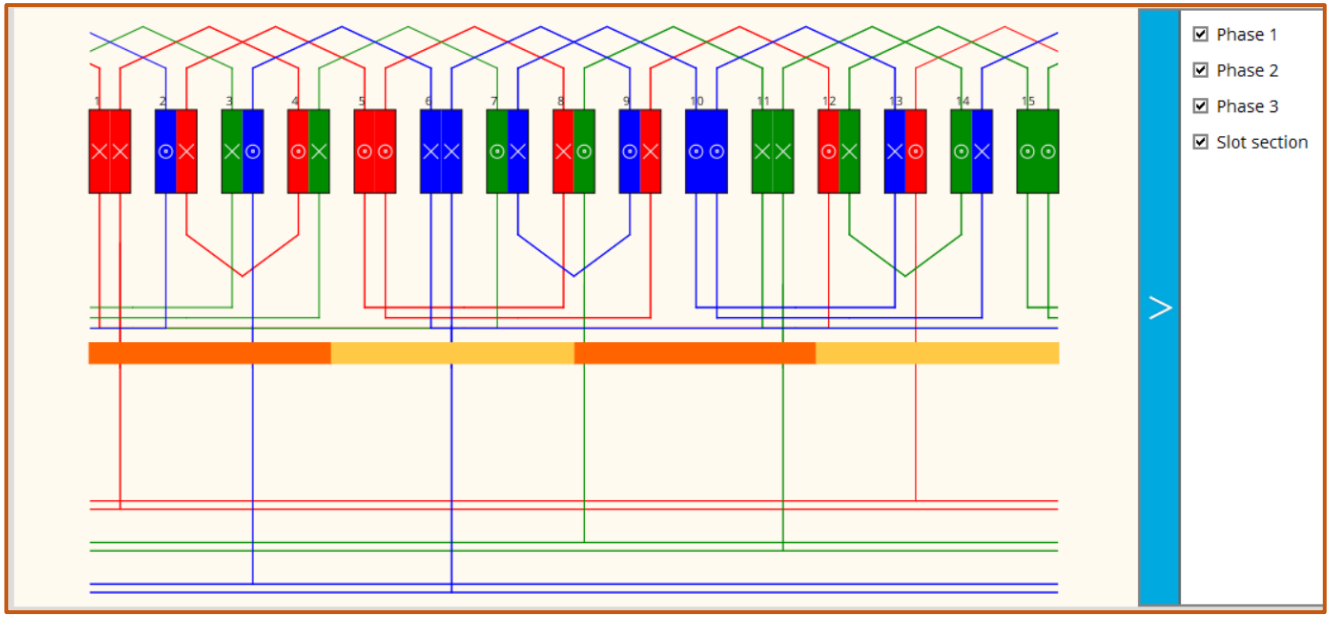




- Slot shape
  - Dimensions
- Stator materials
  - Lamination
  - Wire
  - Insulators
- Winding wizard

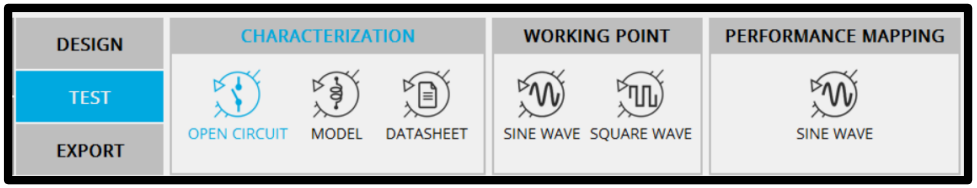
Motor Factory – Design – Stator - Winding

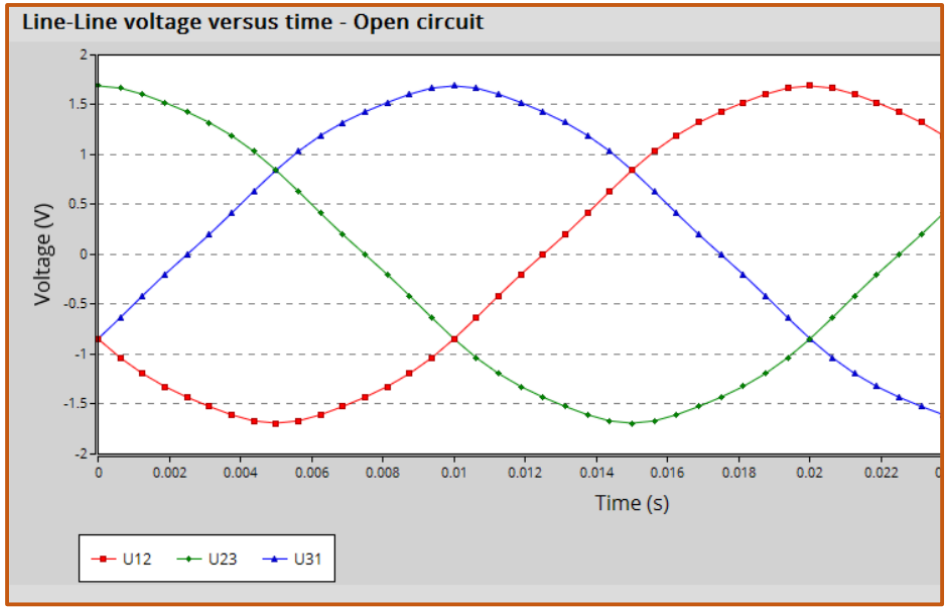
Layout of the winding



- Slot shape
  - Dimensions
- Stator materials
  - Lamination
  - Wire
  - Insulators
- Winding wizard

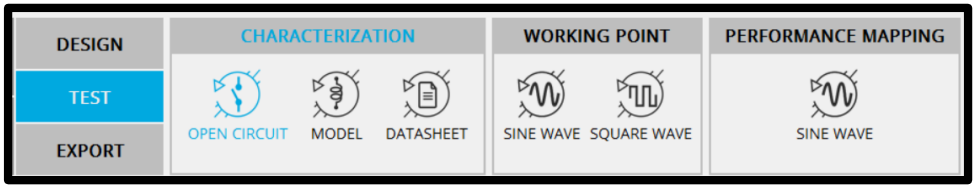
Motor Factory – Test – Open Circuit - BackEMF





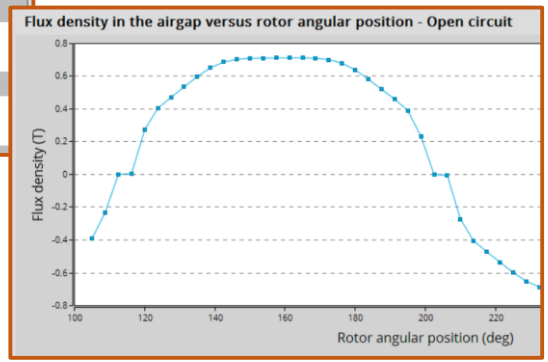
- Charactization
  - Open Circuit
    - Cogging
    - BackEMF
  - Datasheet
- Working Points
  - Sine wave
  - Six step
- Performance
  - Maps
  - Duty cycle

Motor Factory – Test – Datasheet



Machine performance - Base speed point

General data			
Operating mode	Motor		
Mechanical torque (N.m)	**1.21**	**Speed (rpm)**	**13 576.213**
Mechanical power (W)	1 719.56	Machine electrical power (W)	1 909.437
Machine efficiency (%)	**90.056**	Apparent power (VA)	1 913.917
Control angle (deg)	**11.479**	Power factor	9.986 E-1
Line current, rms (A)	**65.0**	Phase current, rms (A)	65.0
Line-Line voltage, rms (V)	**17.0**	Phase voltage, rms (V)	9.815
Machine constants			
Current density, rms (A/mm2)	14.368	Electrical loading, rms (A/m)	36 512.016
kT (N.m/A)	1.316 E-2	kE (V.s/rad)	1.614 E-2
Power balance			
Machine total losses (W)	189.877	Joule losses (W)	111.636
Iron losses (W)	78.241	Additional losses (W)	0.0



- Charactization
  - Open Circuit
    - Cogging
    - BackEMF
  - Datasheet
- Working Points
  - Sine wave
  - Six step
- Performance
  - Maps
  - Duty cycle

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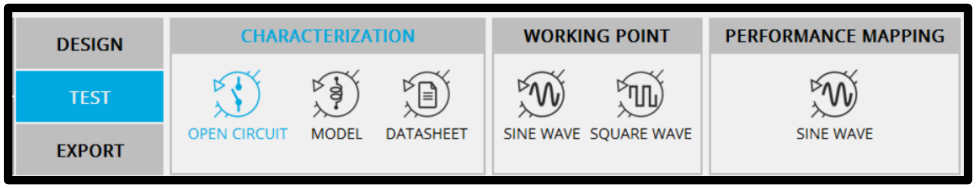
Motor Factory – Test – Working points – sine wave



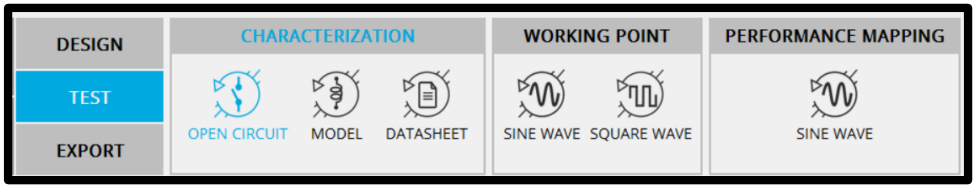
Overview

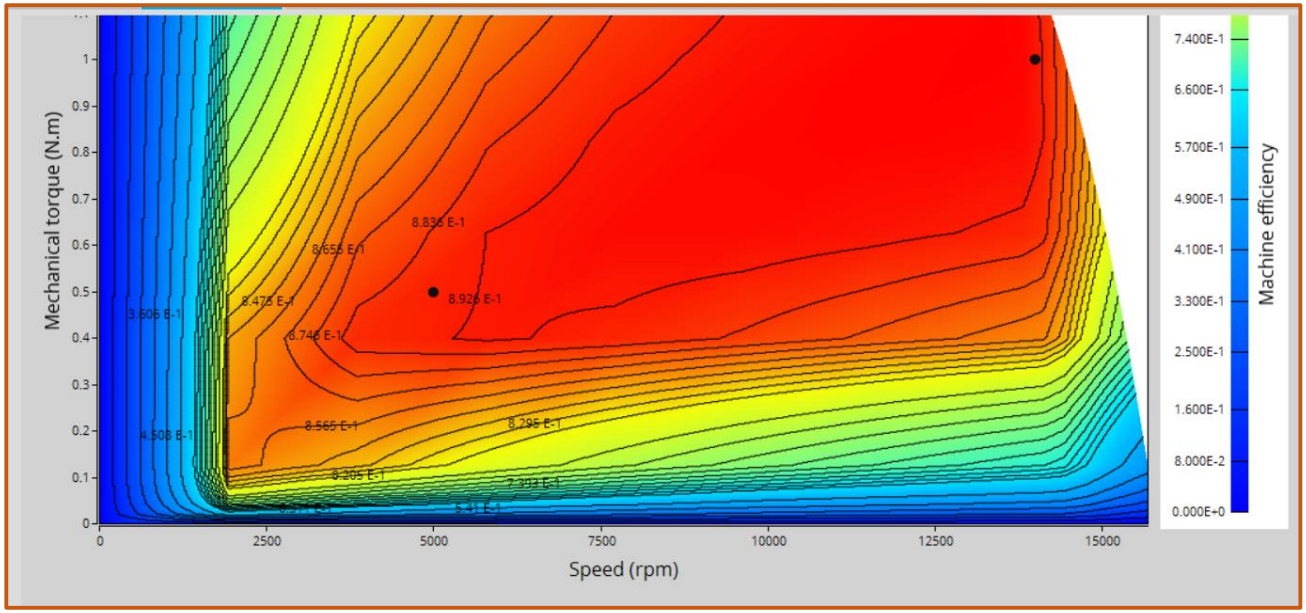
Machine performance - Working point

General data			
Operating mode	Motor		
Mechanical torque (N.m)	**1.0**	**Speed (rpm)**	**14 000.0**
Mechanical power (W)	1 466.079	Machine electrical power (W)	1 625.414
Machine efficiency (%)	**90.197**	Apparent power (VA)	1 627.736
Control angle (deg)	**9.169**	Power factor	9.986 E-1
Line current, rms (A)	**54.101**	Phase current, rms (A)	54.101
Line-Line voltage, rms (V)	**17.371**	Phase voltage, rms (V)	10.029

- Charactization
  - Open Circuit
    - Cogging
    - BackEMF
  - Datasheet
- Working Points
  - Sine wave
  - Six step
- Performance
  - Maps
  - Duty cycle

Motor Factory – Test – Performance





- Charactization
  - Open Circuit
    - Cogging
    - BackEMF
  - Datasheet
- Working Points
  - Sine wave
  - Six step
- Performance
  - Maps
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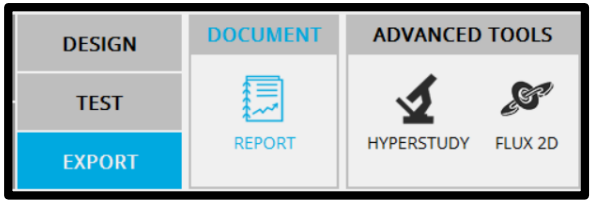
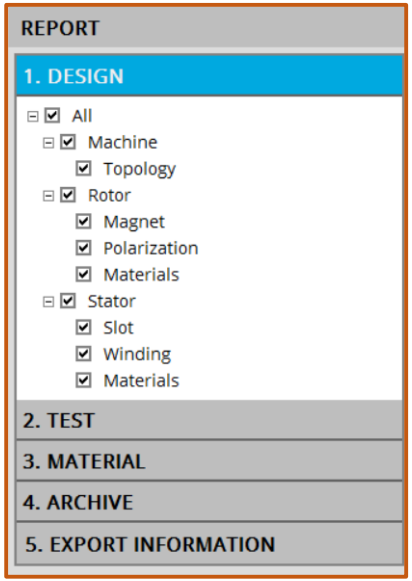
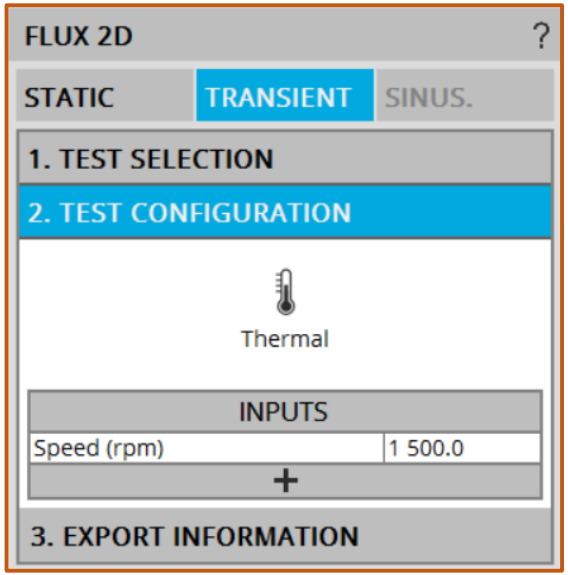
Motor Factory – Export







- Export
  - Document
    - Report
  - Advance tools
    - HyperStudy
    - Flux 2D

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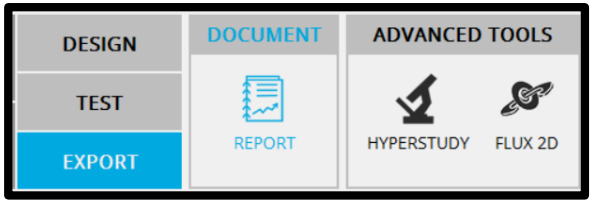
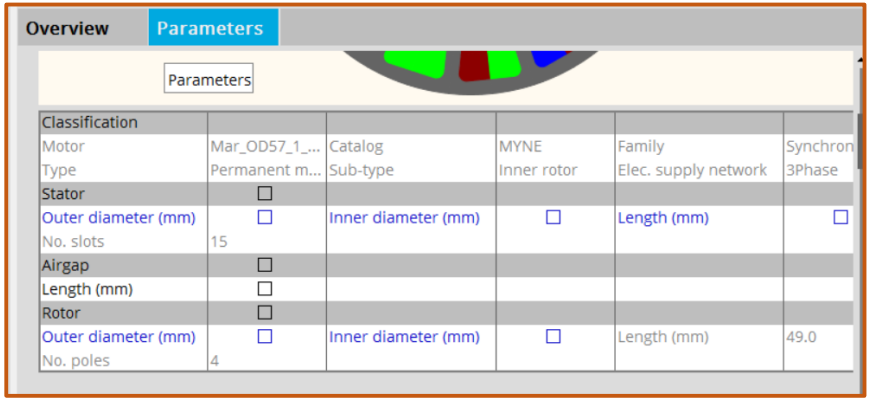
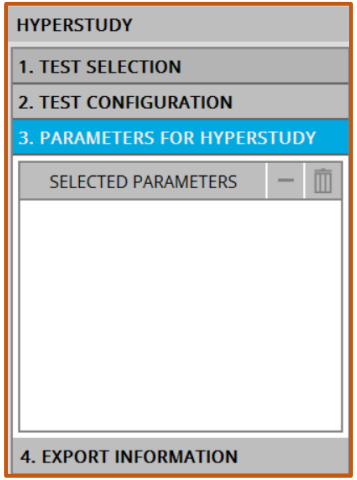
Motor Factory – Export







- Export
  - Document
    - Report
  - Advance tools
    - HyperStudy
    - Flux 2D

Thank you

Questions?

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