

MATLAB EXPO

POLSKA 2024



Oprogramowanie
Naukowo-Techniczne
sp. z o.o.

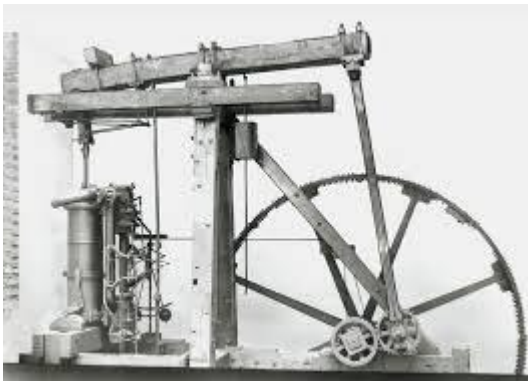
MATLAB EXPO

Warszawa, 4.06.2024 r.

Jak Simscape wspiera elektryfikację?

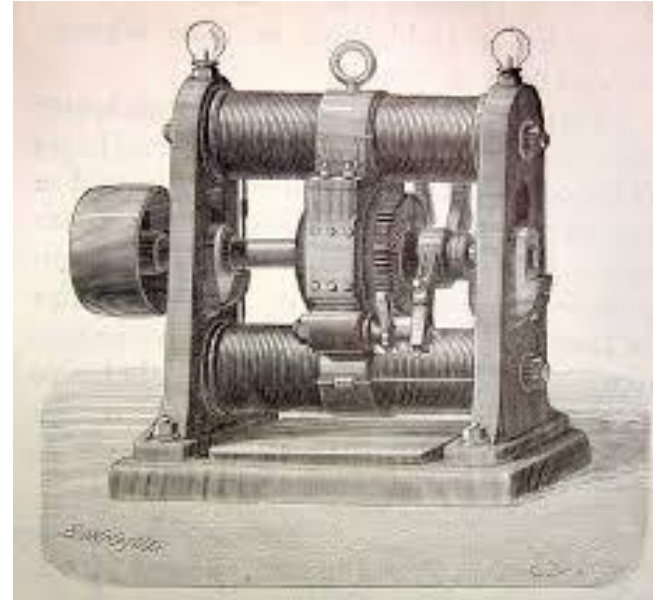
Jakub Szyman, ONT

Technological development



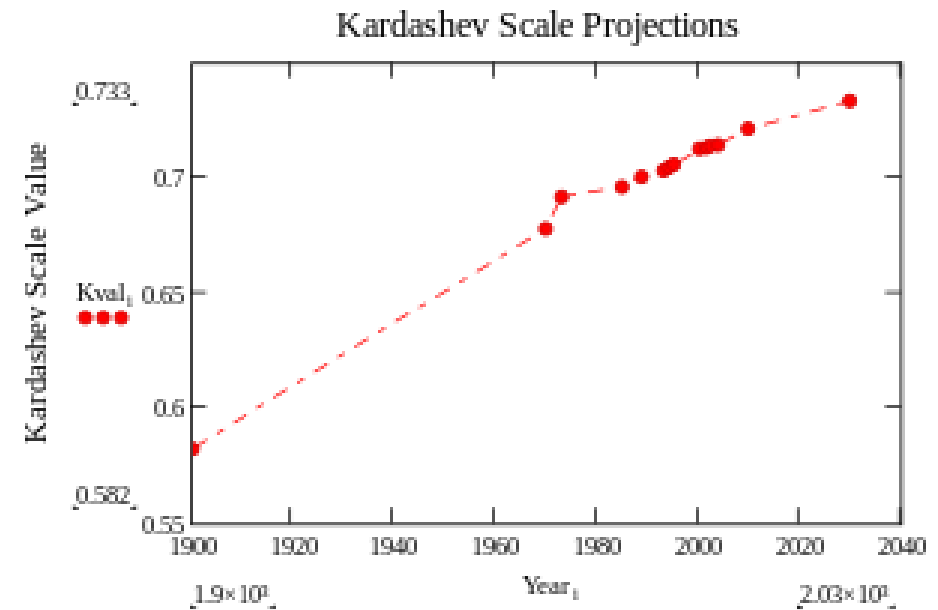
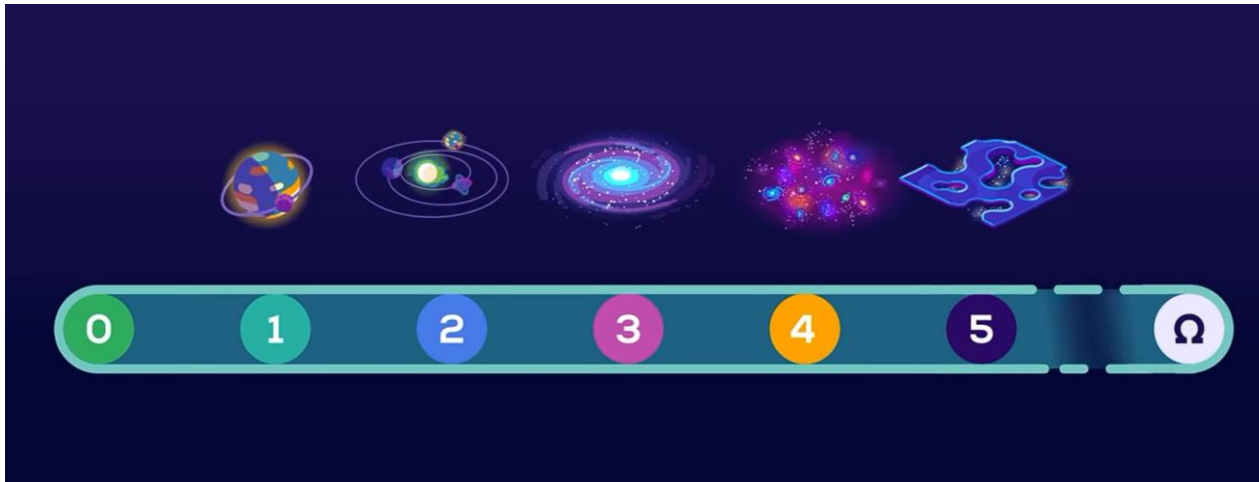
» Sources: Library of Congress, Science Museum, S.J. de Waard

Roots of electrification



» [wikimedia.org](https://www.wikimedia.org)

Energy generation versus civilization development



» Kurzsagt, wikipedia.org

Goals to achieve

Energetical and transport transformation

- Increasing of the energy conversion efficiency
- Independence of fossil fuels

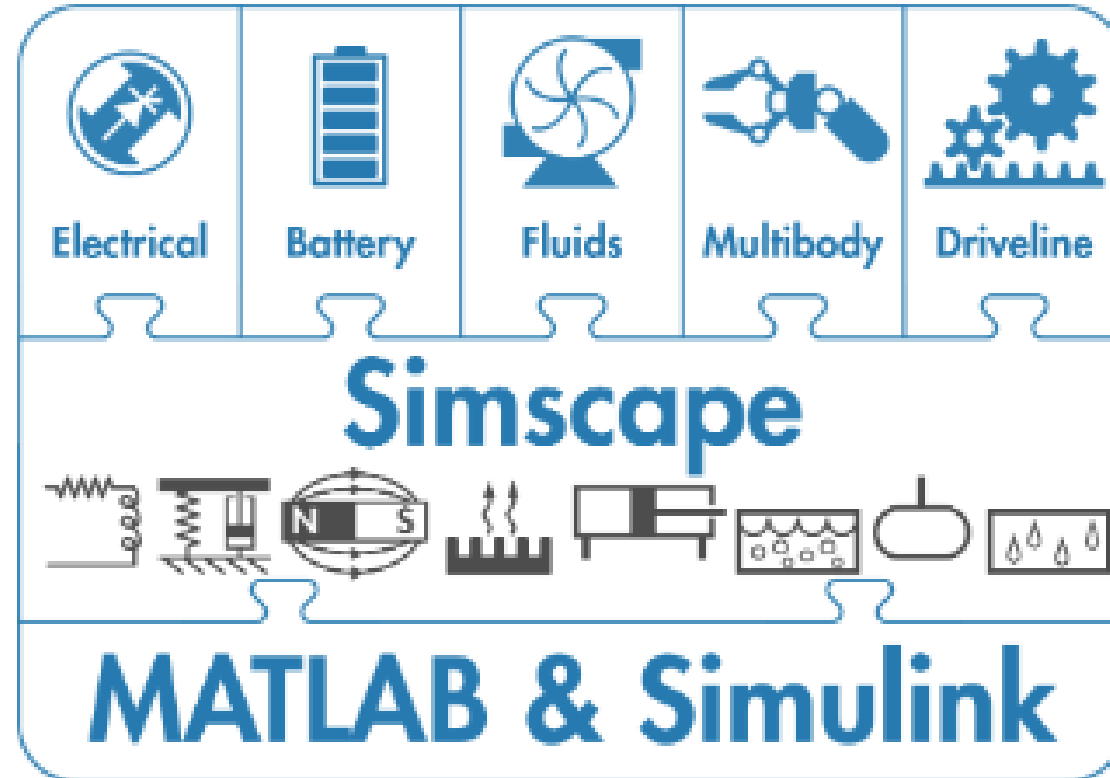
Current challenges

- Electrical energy storage
- E-mobility

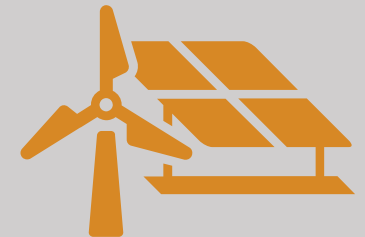
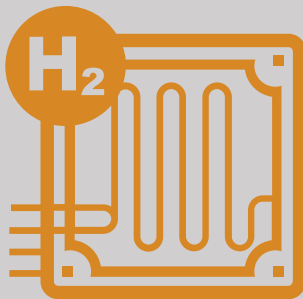
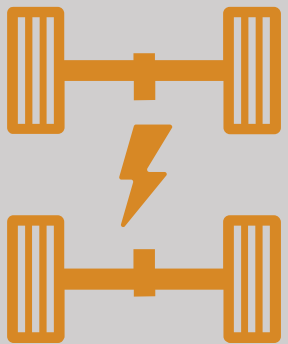
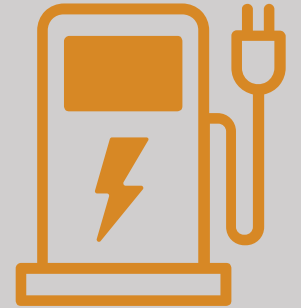
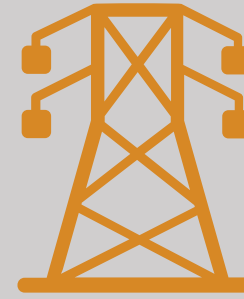
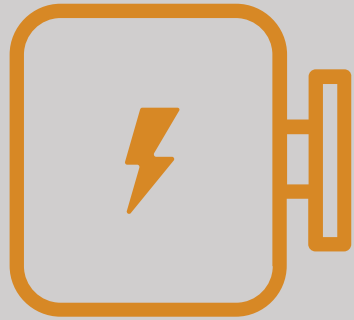
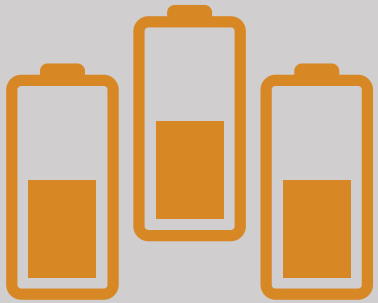
<https://www.deviantart.com/sono2000>



Simscape

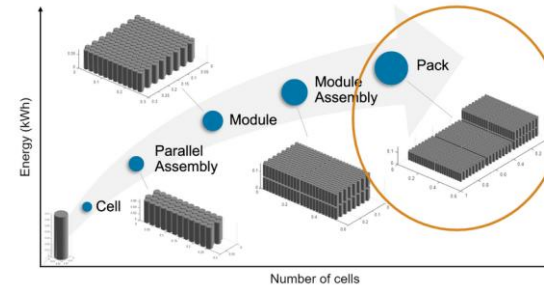


Electrification with Simscape

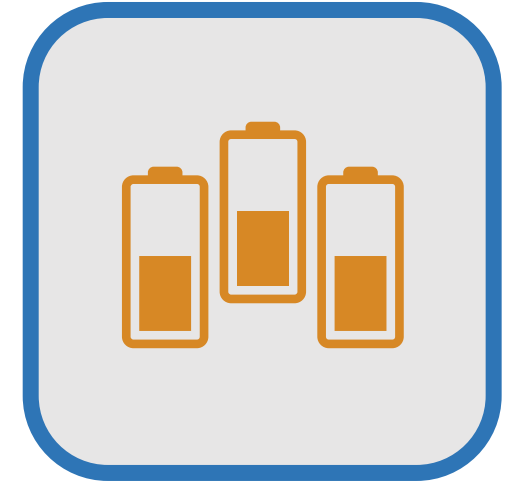
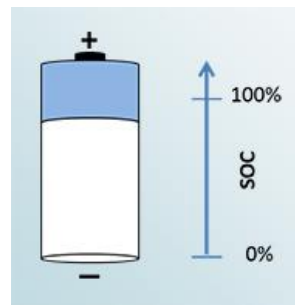
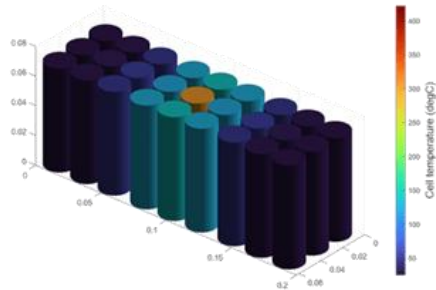


Battery systems

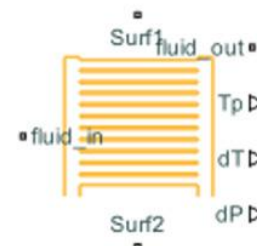
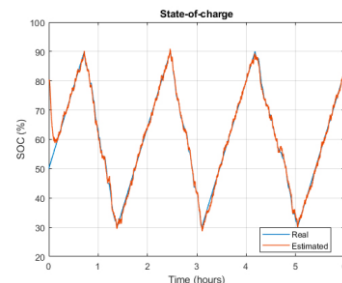
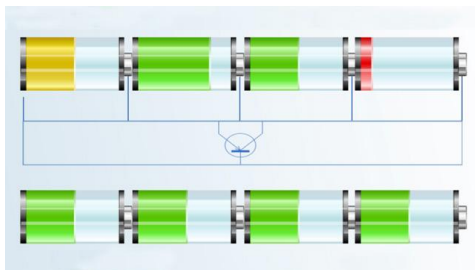
- Modeling the battery from single cell



- Battery management systems (BMS) design

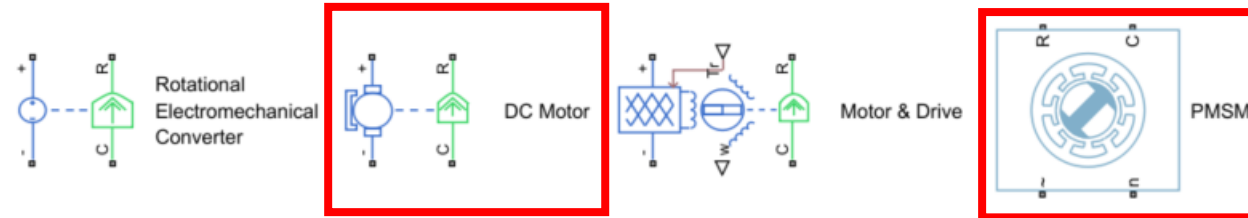


- Cycling, cell balancing and cooling system design

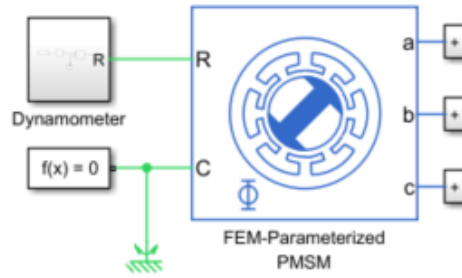
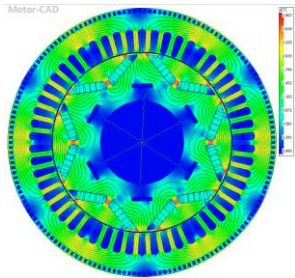


Motor Drives and Traction Motor

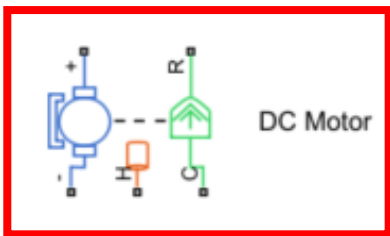
- Set of components at different level of fidelity



- Possibility to implement the FEM results



- Thermal and fault analysis



Block Parameterization Manager: DC Motor

SELECT FORMAT

Apply all Reset all Manufacturer: All

PARAMETERIZE

Select part

Part number	Manufacturer	M
DC040A_2	AMETEK	PM
GM8224S028	AMETEK	PM
GM9234S023_R1	AMETEK	PM
GM9236S020_R1	AMETEK	PM
GM9236S024	AMETEK	PM
9237S011_R1_SP	AMETEK	PM
89_800_003	Crouzet	PM
89_800_008	Crouzet	PM
89_810_003	Crouzet	PM
89_810_007	Crouzet	PM

Block Parameters: DC Motor

DC Motor Auto Apply

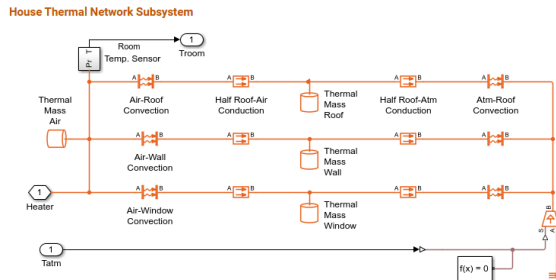
Settings Description

NAME	VALUE
Modeling option	Show thermal port
Selected part	<click to select>
Electrical Torque	
Field type	Permanent magnet
Model parameterization	By equivalent circuit parameters
Armature resistance	3.9 Ohm
Armature inductance	12e-6 H
Define back-emf or torque constant	Specify back-emf constant
Back-emf constant	0.072e-3 V/rpm
Rotor damping parameterization	By damping value
Mechanical	
Temperature Dependence	
Thermal Port	
Faults	
Armature winding fault	Add fault
Add fault	

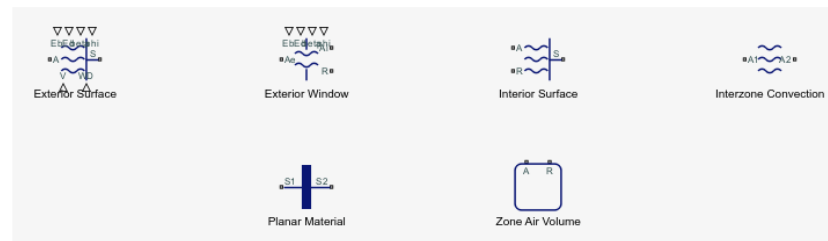
Parameter name					
Electrical Torque>Field resistance	Parameter not set	<input type="checkbox"/>	0	0	A
Electrical Torque>Field inductance	Parameter not set	<input type="checkbox"/>	0	0	A
Electrical Torque>Field-armature mutual inductance	Parameter not set	<input type="checkbox"/>	0	0	A
Electrical Torque>Initial field current	Parameter not set	<input type="checkbox"/>	0	0	A
Electrical Torque>Armature resistance	Datasheet derived	<input checked="" type="checkbox"/>	8.33	3.9	Ohm
Electrical Torque>Armature inductance	Datasheet derived	<input checked="" type="checkbox"/>	0.00617	1.2e-05	H
Electrical Torque>Back-emf constant	Datasheet derived	<input checked="" type="checkbox"/>	0.00414	7.2e-05	V/rpm
Electrical Torque>Torque constant	Parameter estimated	<input checked="" type="checkbox"/>	0.03953409	0.0006876	N*m/A
Electrical Torque>Stall torque	Parameter not set	<input type="checkbox"/>	0.00024	0.00024	N*m
Electrical Torque>No-load speed	Parameter not set	<input type="checkbox"/>	19100	19100	rpm
Electrical Torque>Rated speed (at rated load)	Parameter not set	<input type="checkbox"/>	15000	15000	rpm

Building Energy Management

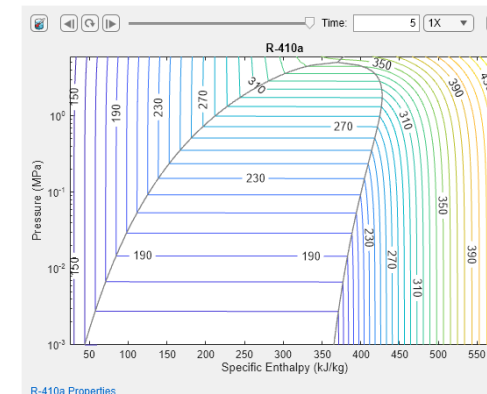
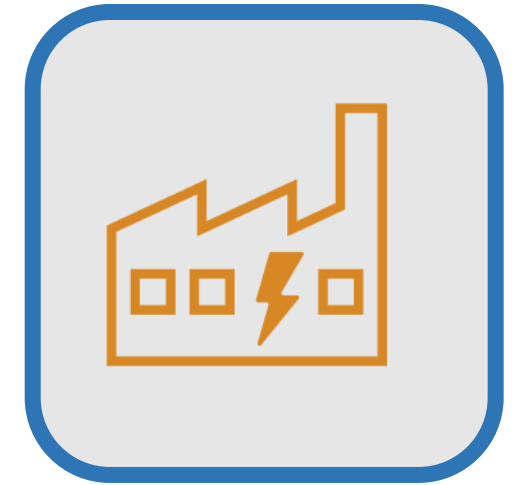
- Thermal modeling of house heating system



- Custom building HVAC library

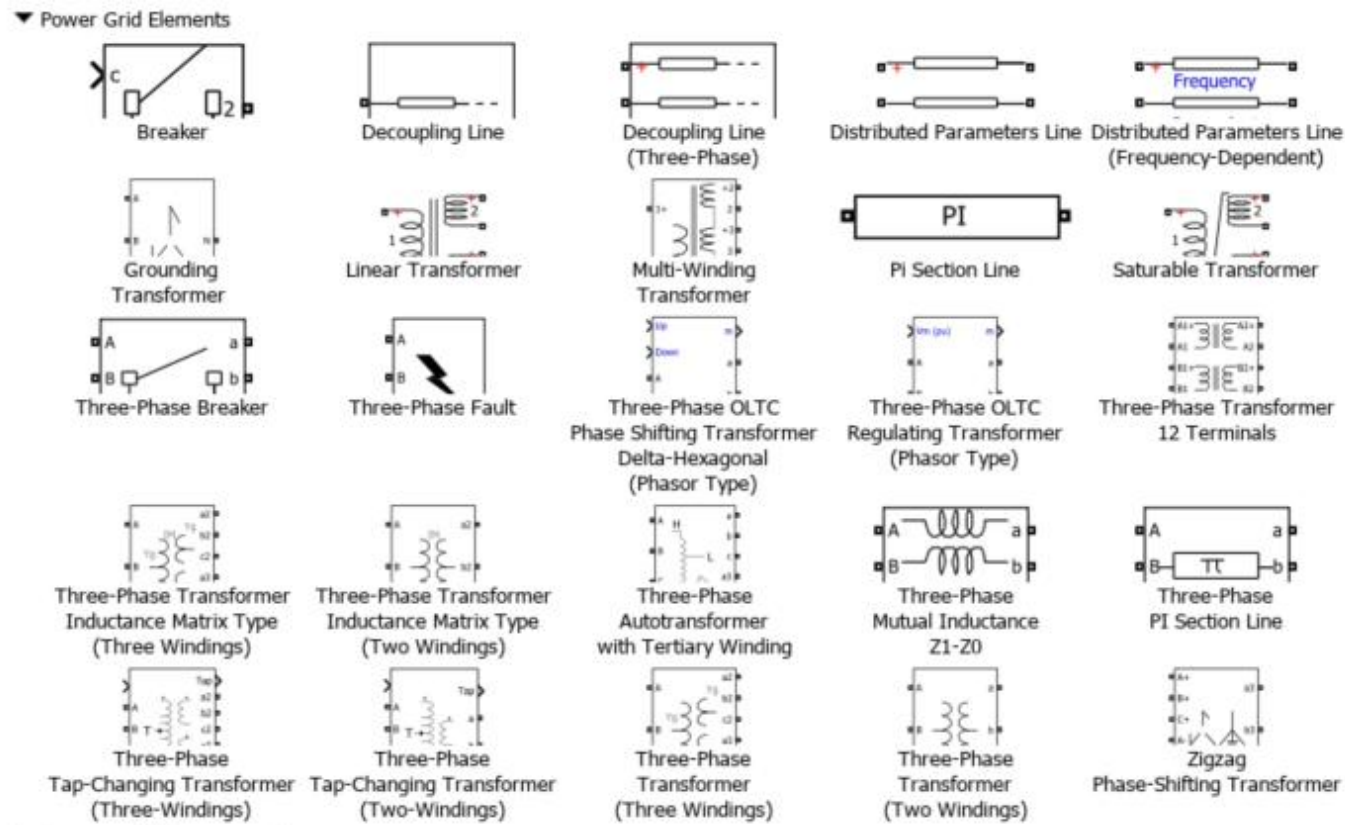


- Refrigeration cycles, useful in heat pumps



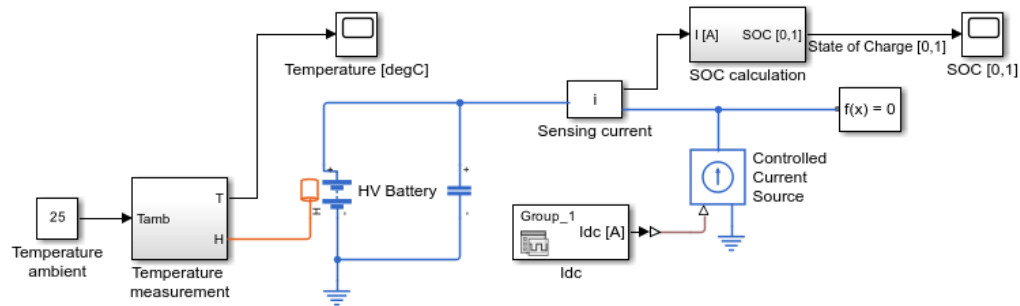
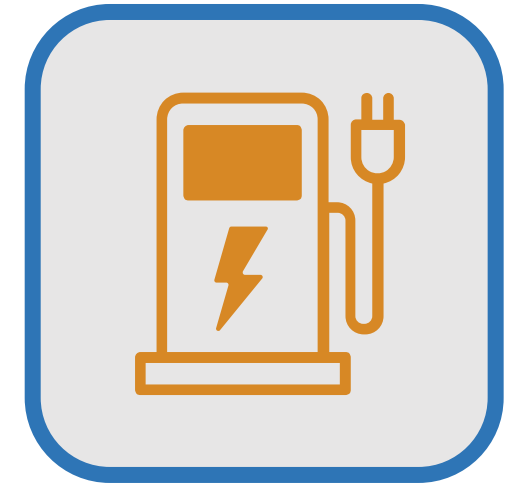
Generation, Transmission & Distribution

- Dedicated, specialised library for power systems

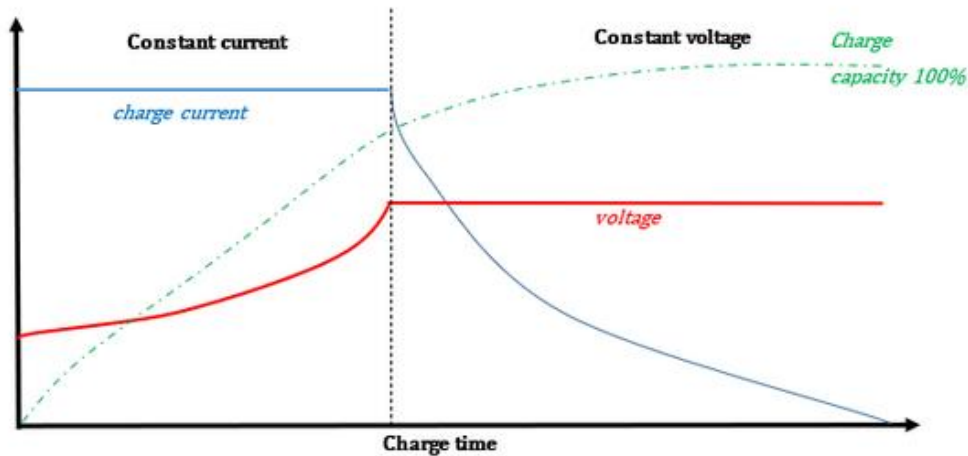


Fast charging

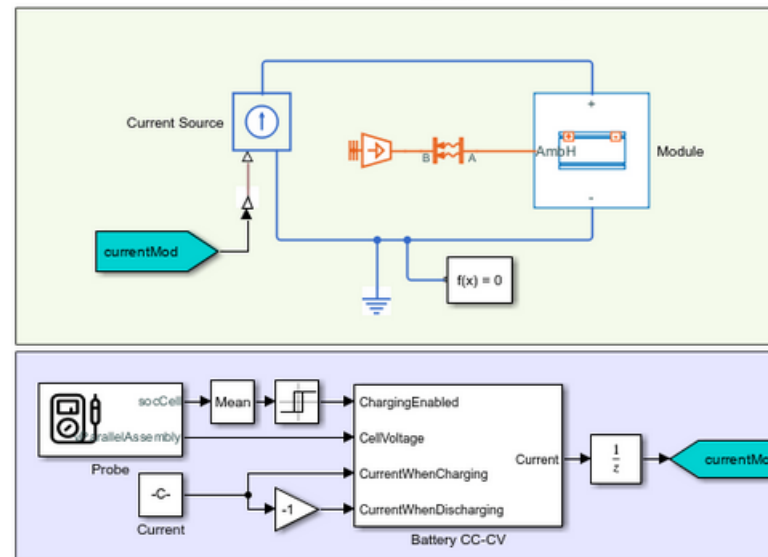
- BMS systems with cyclers and predefined CC-CV Charging algorithms



HV Battery Charge/Discharge

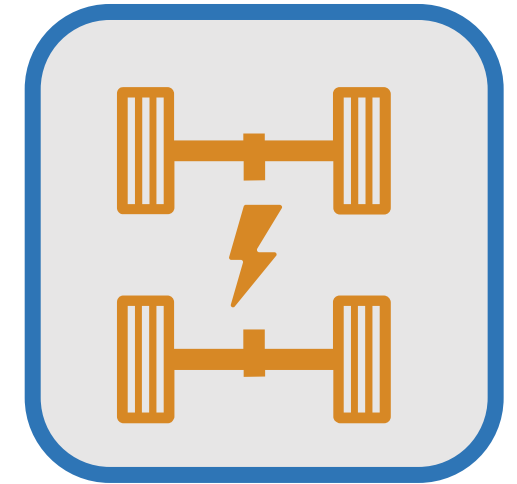
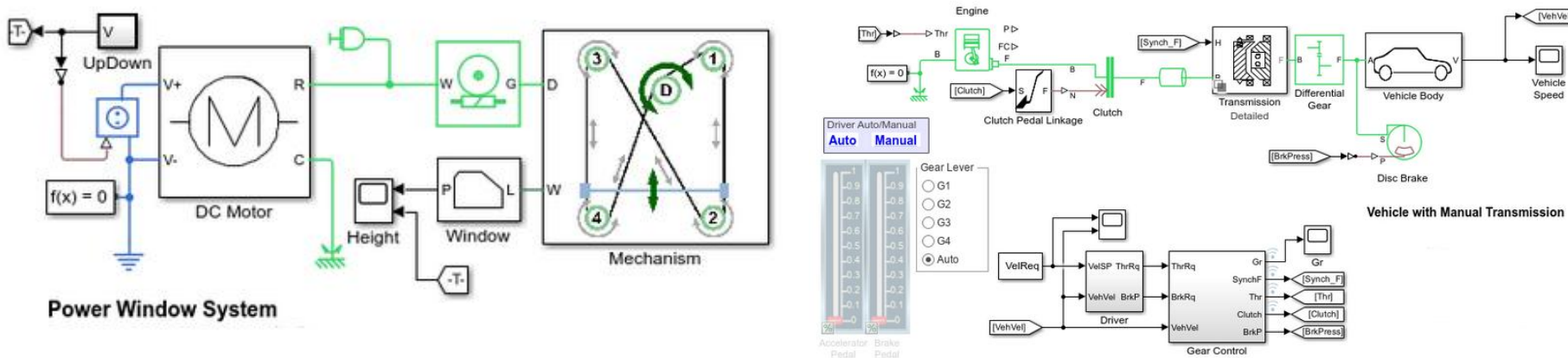


Perform Controlled Charging and Discharging on Battery Module



Electric Vehicles & Transportation

- Driveline elements in Simscape Driveline



- Generic Vehicle models generated by Virtual Vehicle Composer

The screenshot shows the Virtual Vehicle Composer interface. On the left is a "Component Selection" tree with categories like Chassis, Front/Rear Tire, Brake System, Powertrain, and Electrical System. The main area displays a 3D model of a car chassis with a "Vehicle Body 3DOF Longitudinal" chassis selected. A diagram below the model shows the sprung mass m_{sprung} and unsprung masses m_{Twp} and m_{Trpr} , along with distances D_{Cmfr} and D_{Cmfr} . A table lists parameters for the model:

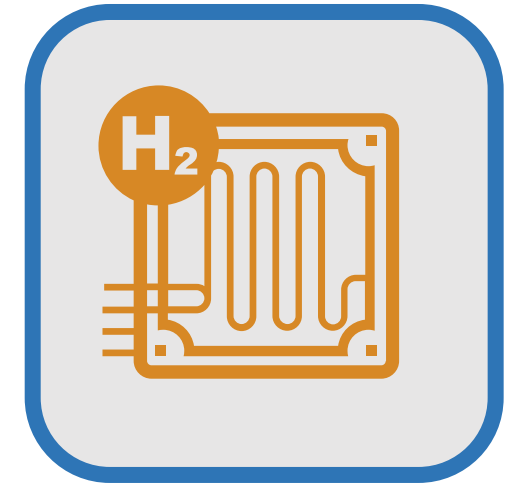
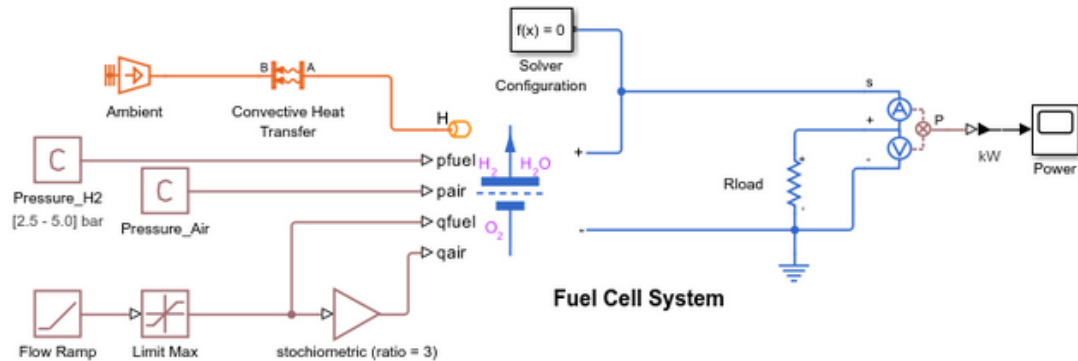
Symbol	Parameter Name
m_{sprung}	PIntVehMass
D_{Cmfr}	PIntVehDistCGFmAxl
D_{Cmfr}	PIntVehDistCGRearAxl
h_{Cmfr}	PIntVehCGHgtAxl

Below this, a "Parameters" table provides detailed information:

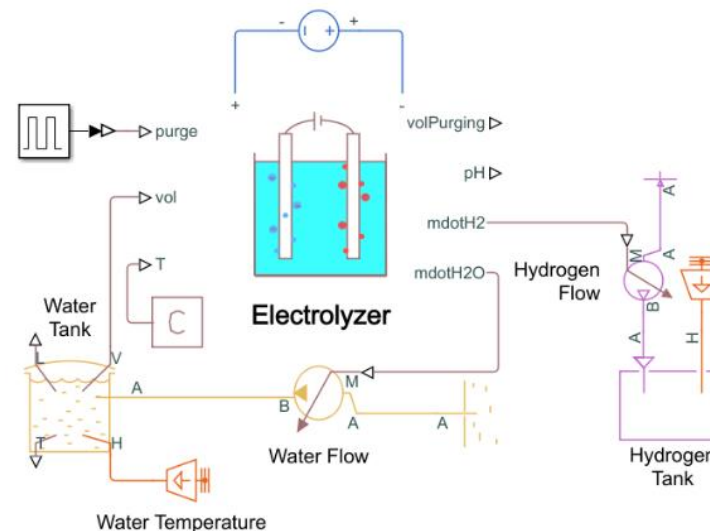
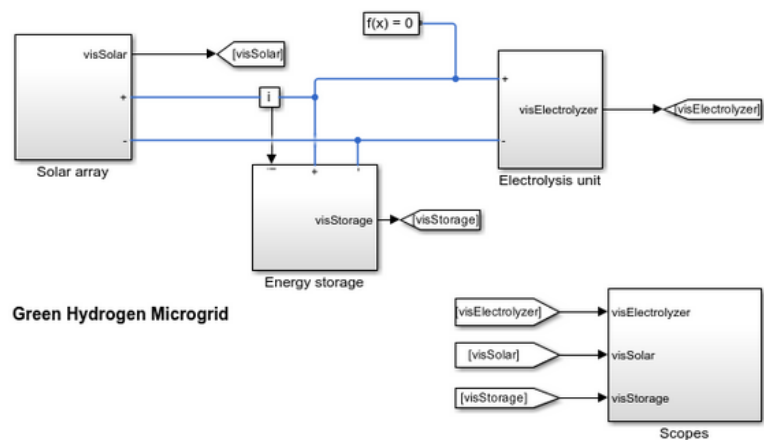
Parameter Name	Description	Units	Value
1 PIntVehMass	Vehicle sprung mass with body fully equipped	kg	1623
2 PIntVehDistCGFmAxl	Longitudinal distance from sprung mass CM to front axle	m	1.09
3 PIntVehDistCGRearAxl	Longitudinal distance from sprung mass CM to rear axle	m	1.7
4 PIntVehCGHgtAxl	Vertical distance from axle plane to sprung mass CM	m	0.3
5 PIntVehPitchMomentInertia	Moment of inertia about the pitch axis	kg/m ²	1922.7
6 PIntVehAeroFmArea	Frontal area of vehicle	m ²	2.27

Fuel Cells & Electrolyzers

- Fuel cell simulation with using of Simscape block

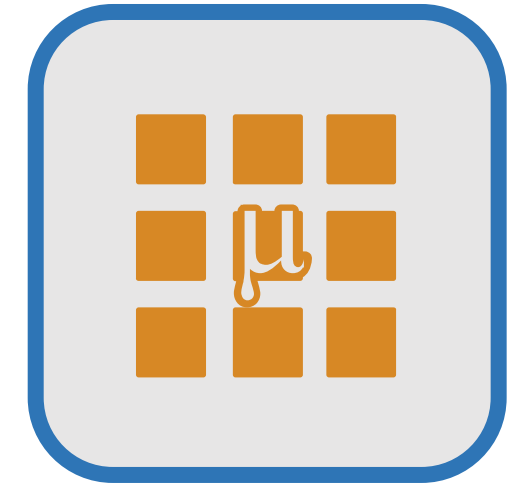
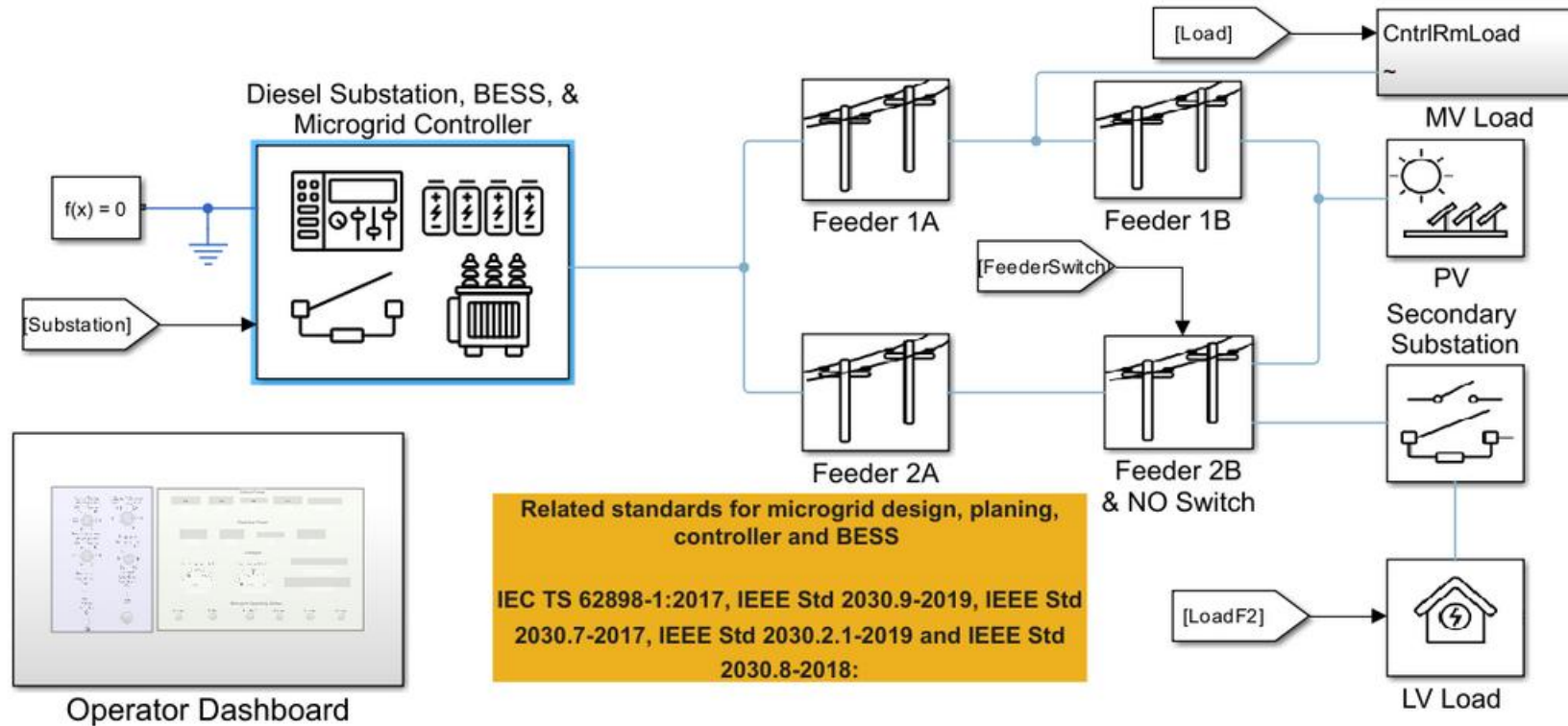


- Hydrogen production due to electrolyzing



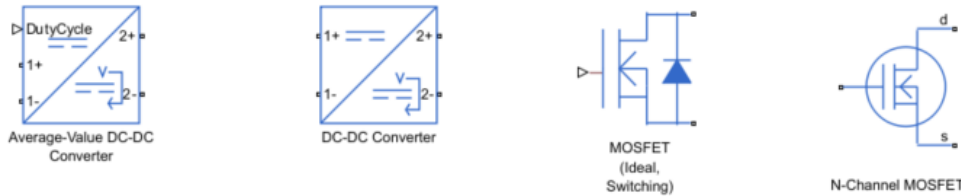
Microgrid, Smartgrid & Charging Infrastructure

- Desinging of normalized microgrid in Simscape

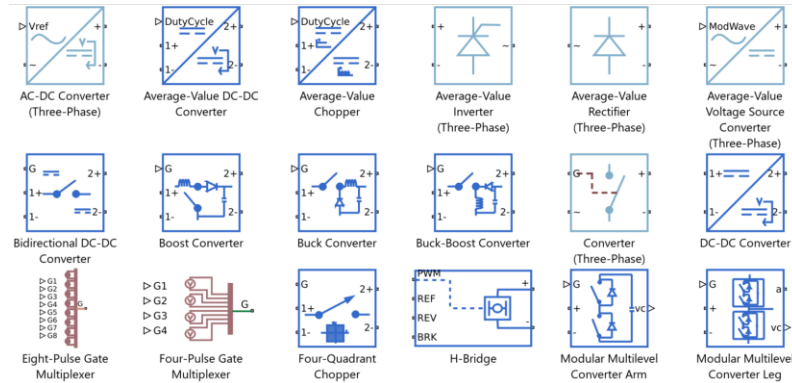


Power Conversion

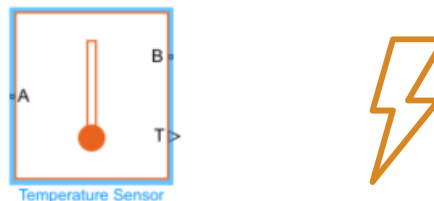
- Variety of level of fidelity approaches



- Semiconductors library

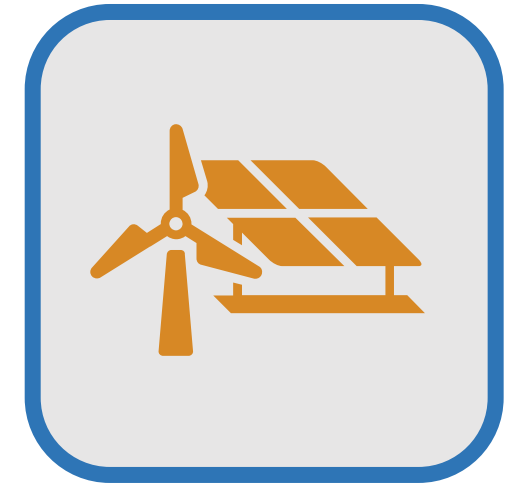
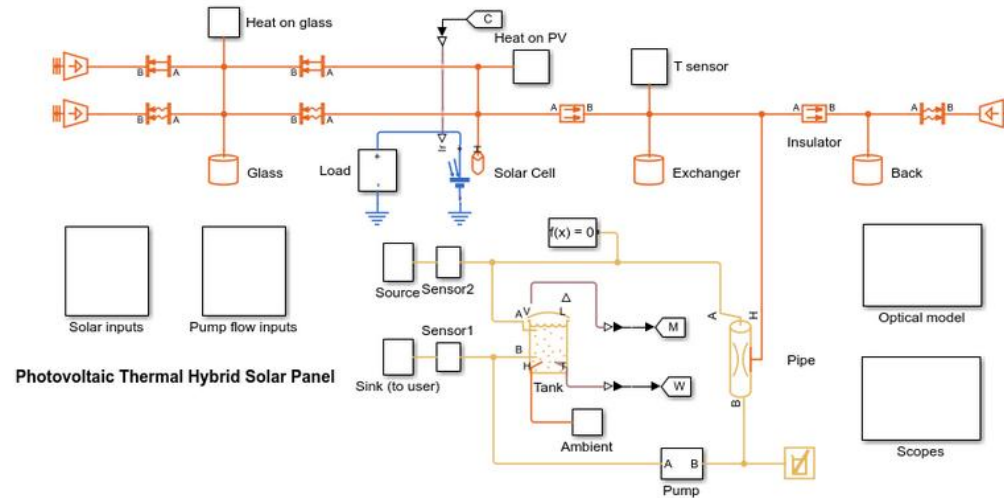


- Thermal and fault analysis available

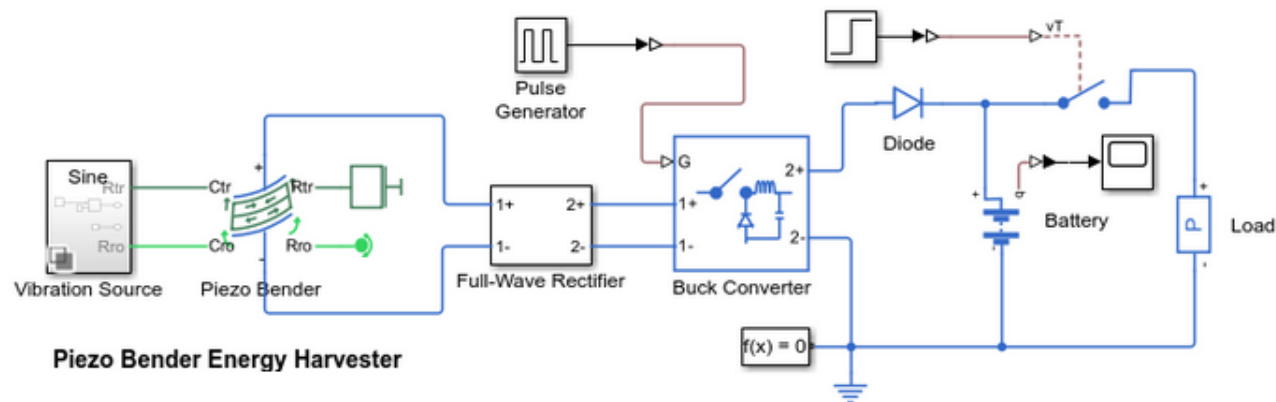


Renewable Energy & Energy Storage

- Photovoltaic + solar panel



- Piezoelectric generation



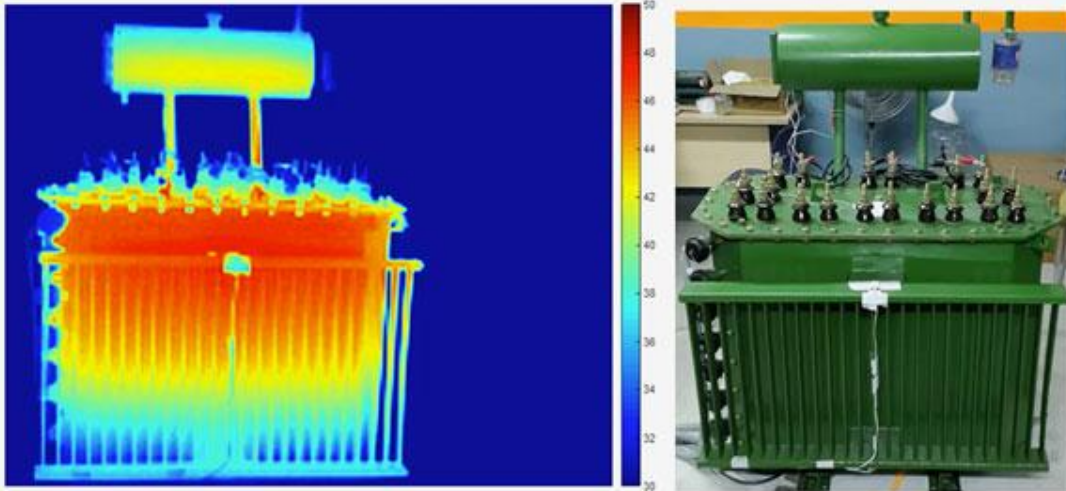


Multi-domain modeling in Simscape

Electrical + Thermal

Using the concept of convective heat transfer to estimate the amount of oil in a transformer tank

SIEMENS
Ingenuity for Life



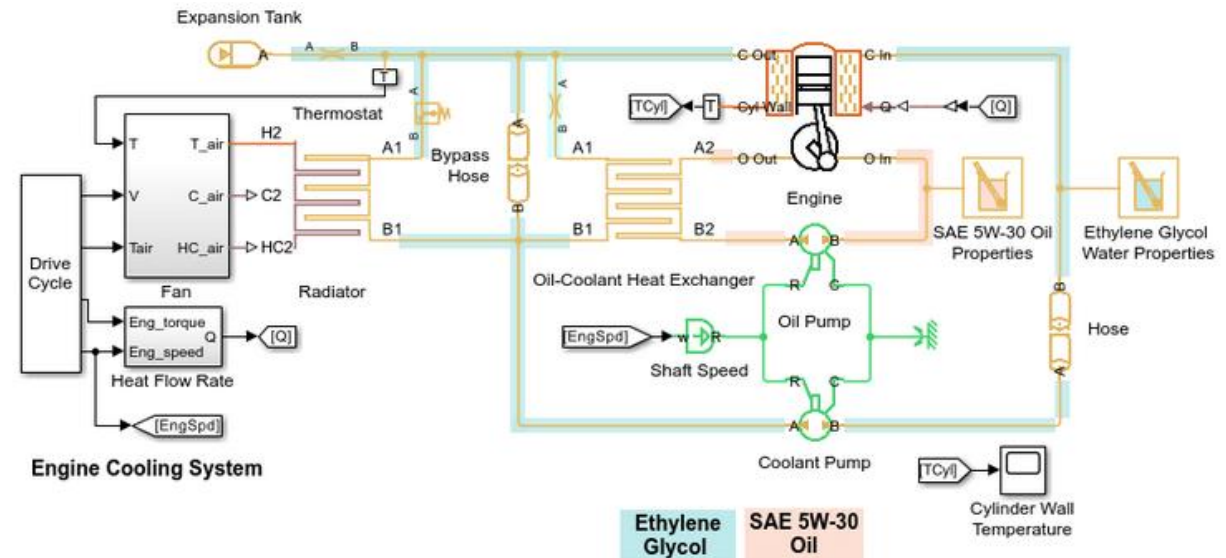
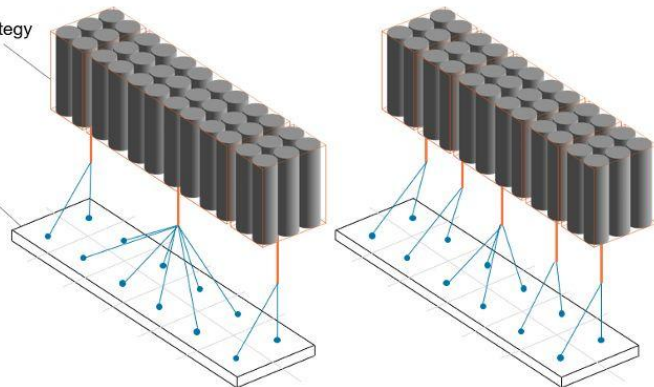
Restricted © Siemens AG 2020

Smit Pradhan | Corporate Technology

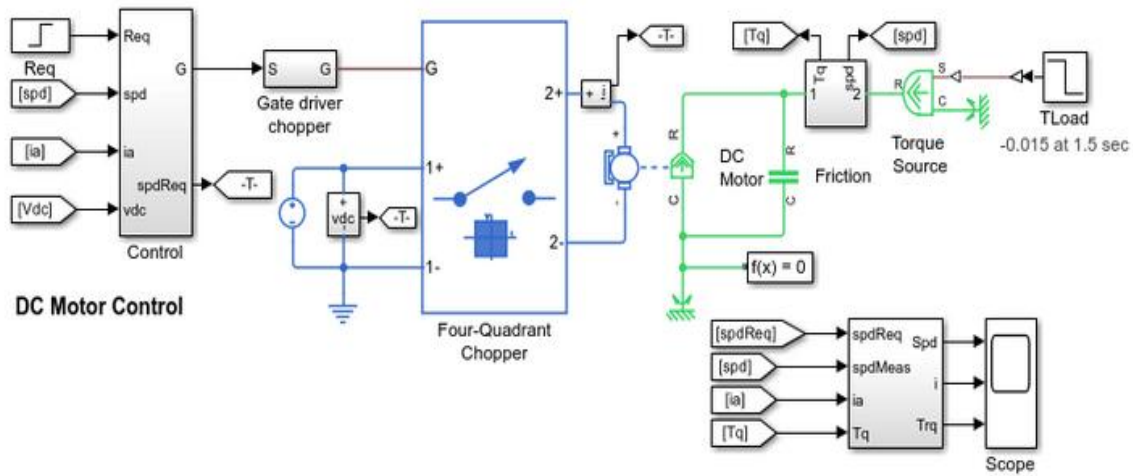
- Thermal analysis of circuits and batteries
- Heat generation
- Cooling systems (with fluids)
- Thermal fault analyzing

Battery Simulation Strategy

Cooling plate

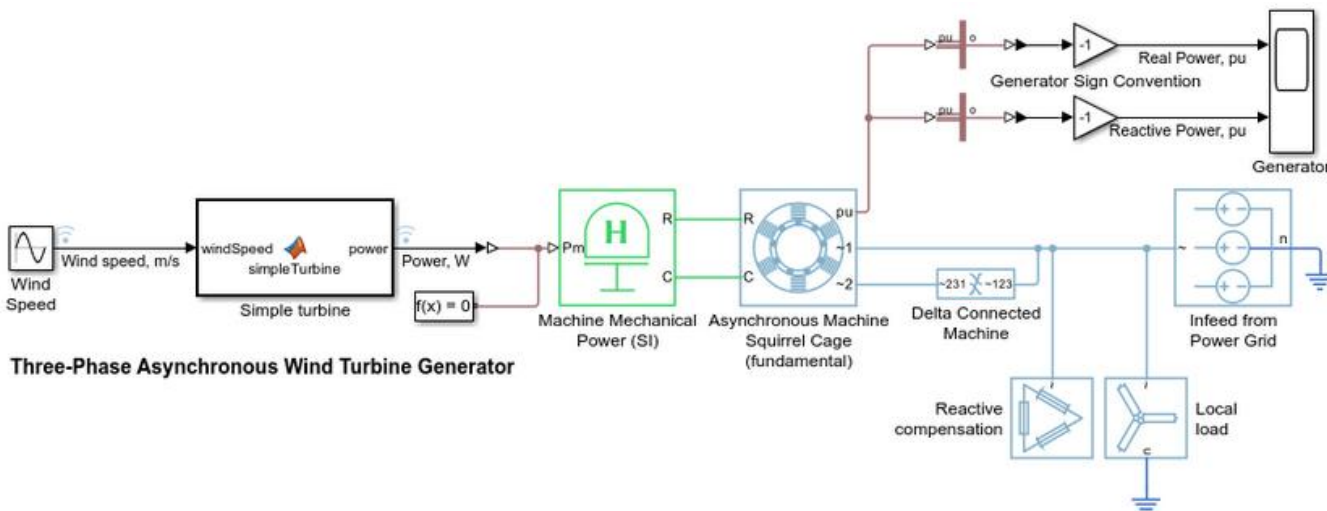


Electrical + Mechanical

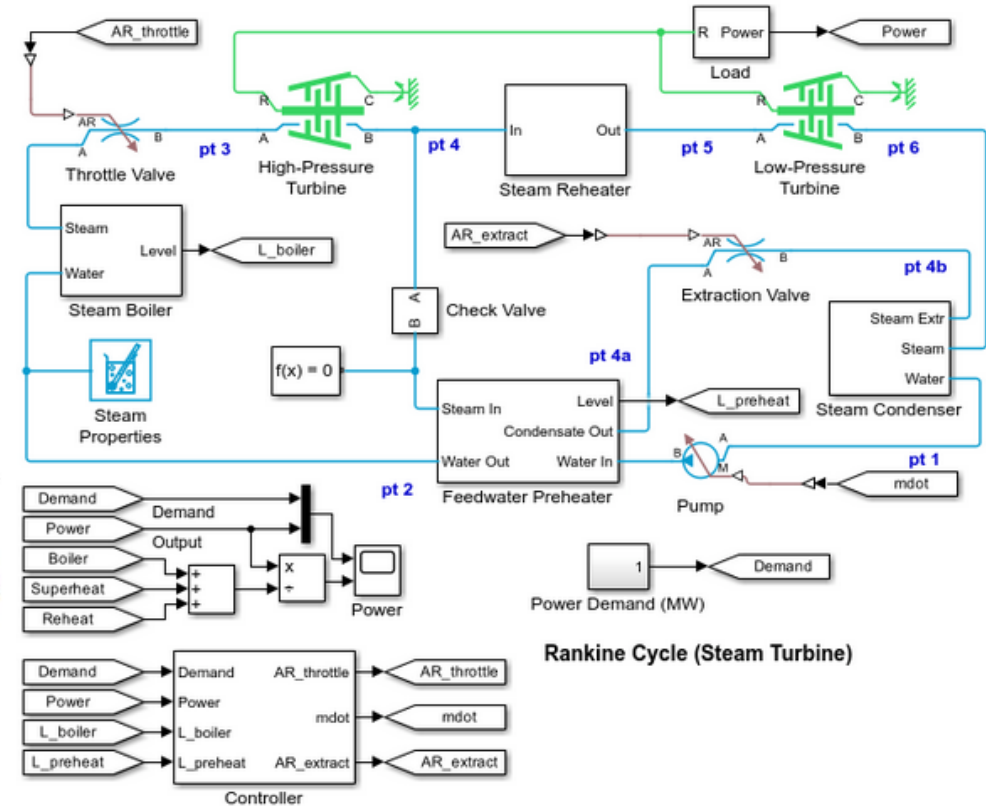


DC Motor Control

- Motors
- Generators

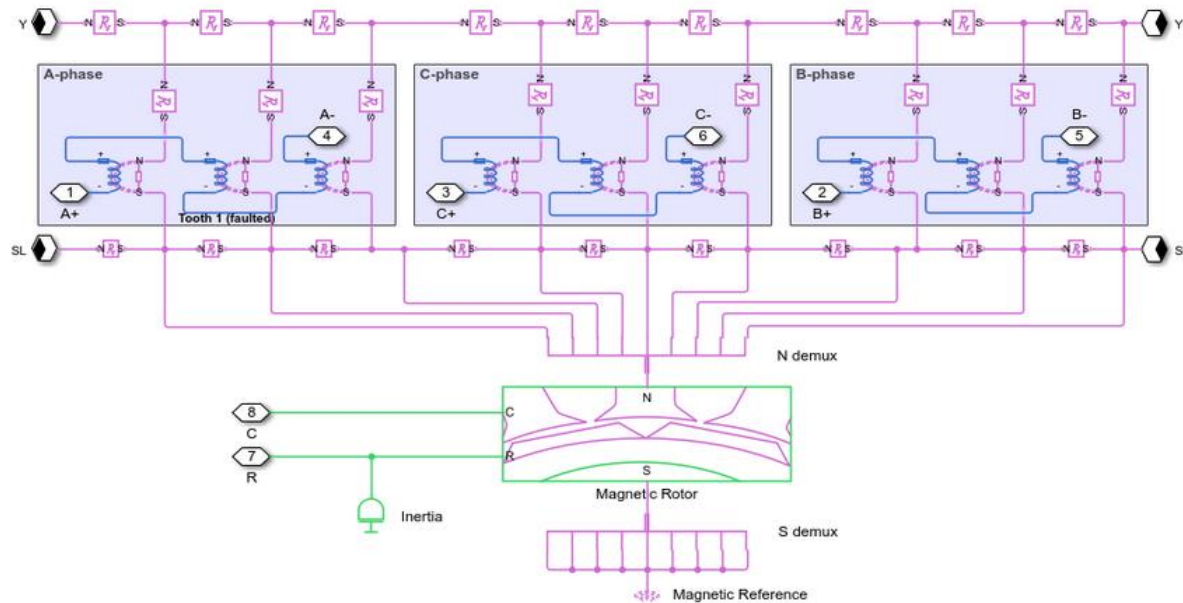


Three-Phase Asynchronous Wind Turbine Generator

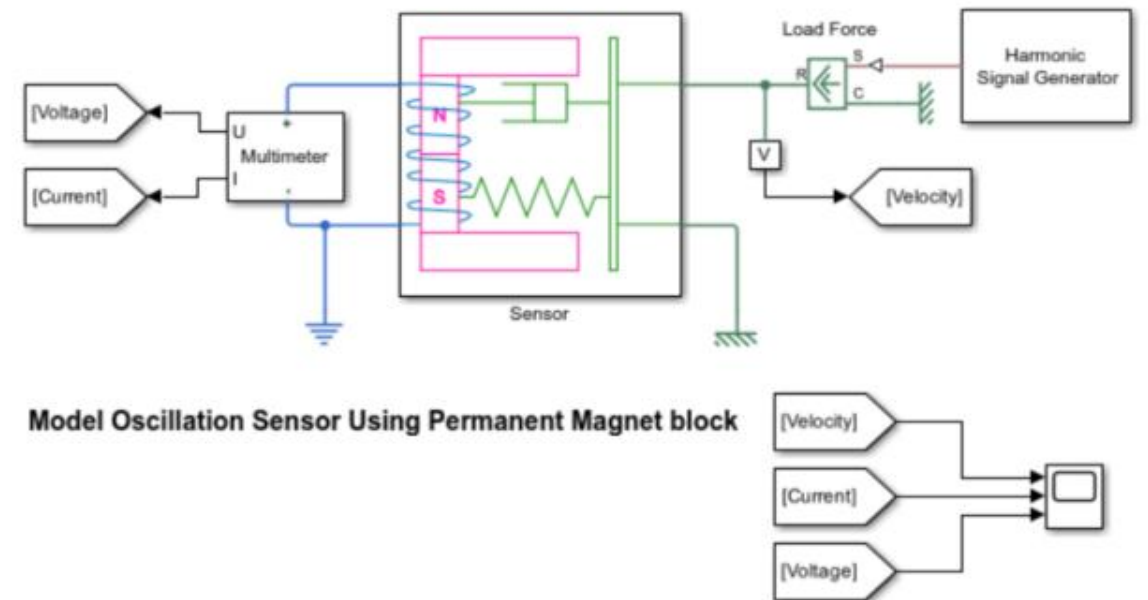


Rankine Cycle (Steam Turbine)

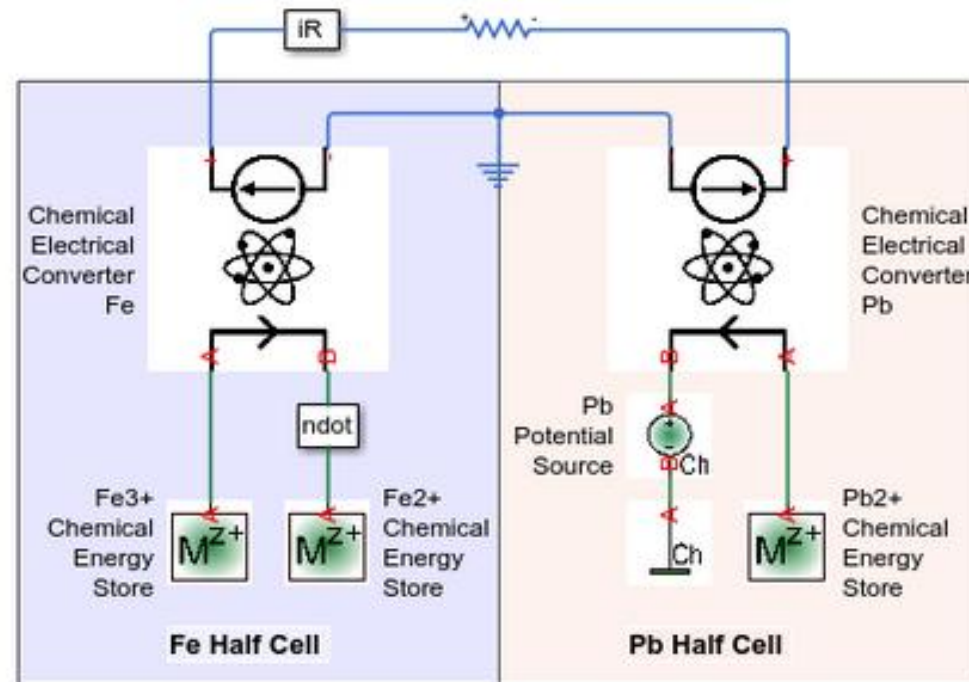
Electrical + Magnetics



Detailed analysis of electromagnetic machines



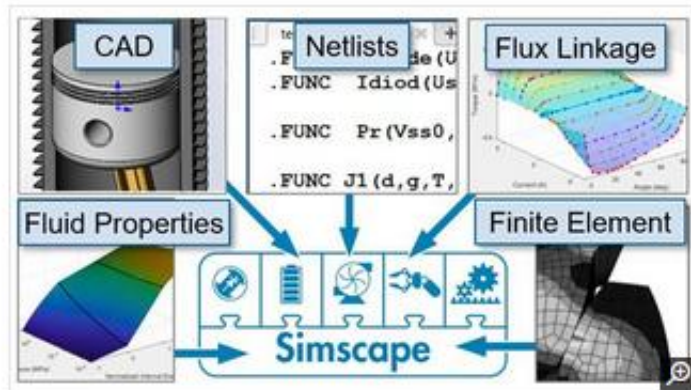
Electrical + Chemical



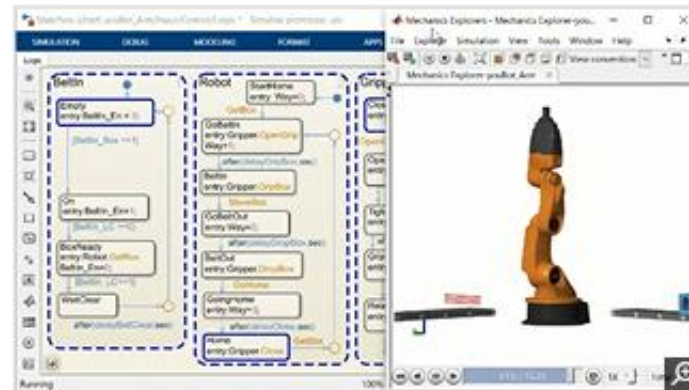
Battery Cell with Custom Electrochemical Domain



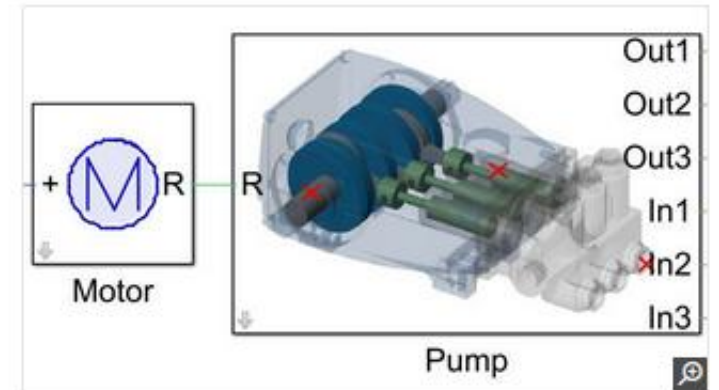
Possibilities with Simscape



Simscape Product Family



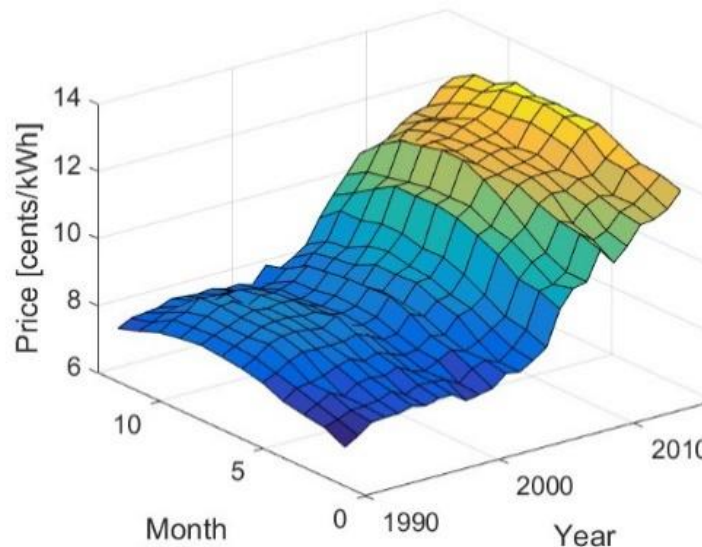
MATLAB and Simulink



From Research To Production

Szkolenia w ONT

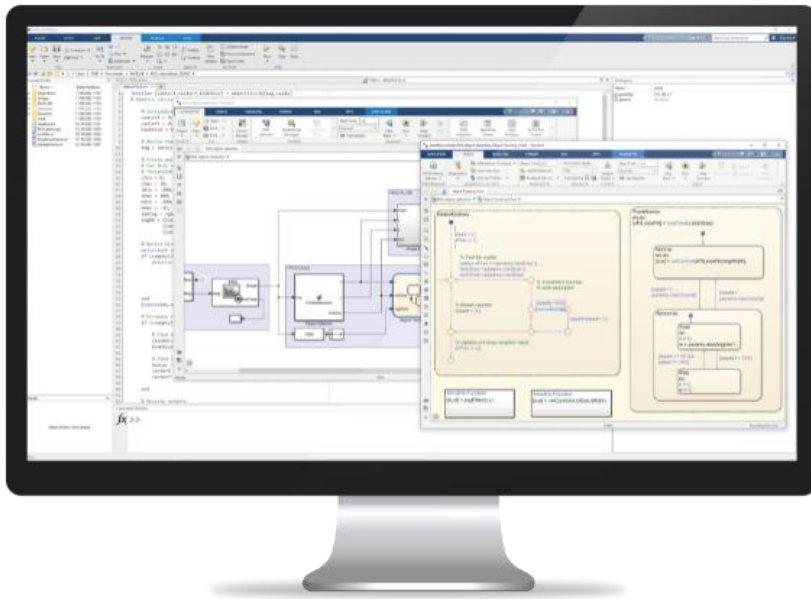
- Ponad 50 szkoleń z 13 obszarów wiedzy
- Szkolenia dla początkujących oraz zaawansowanych uczestników
- Nauka przez praktykę – przygotowane ćwiczenia do każdego tematu
- Zajęcia organizowane przez oficjalnego dystrybutora firmy MathWorks i prowadzone przez specjalistów
- Nieduże grupy – do 12 osób
- [Grafik szkoleń otwartych](#)



Dane kontaktowe:
szkolenia@ont.com.pl
+48 12 630 49 55

APPLICATIONS

- ▶ Robotics and Automation
- ▶ Computational Finance
- ▶ Autonomous Vehicles
- ▶ Electronics
- ▶ Artificial Intelligence
- ▶ Biomedical Engineering
- ▶ Systems Engineering and certification
- ▶ Power Electronics and Systems
- ▶ Communications and Radar Systems



Let's stay in touch

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MATLAB EXPO

Warszawa | 4.06.2024

Jakub Szyman

AE, ONT

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The logo for MATLAB EXPO POLSKA 2024. The word 'MATLAB' is in a light orange, sans-serif font. 'EXPO' is in a larger, bold, yellow-to-orange gradient font. 'POLSKA 2024' is in a smaller, yellow-to-orange gradient font. The background is dark blue with a network of orange lines and dots on the left side.

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