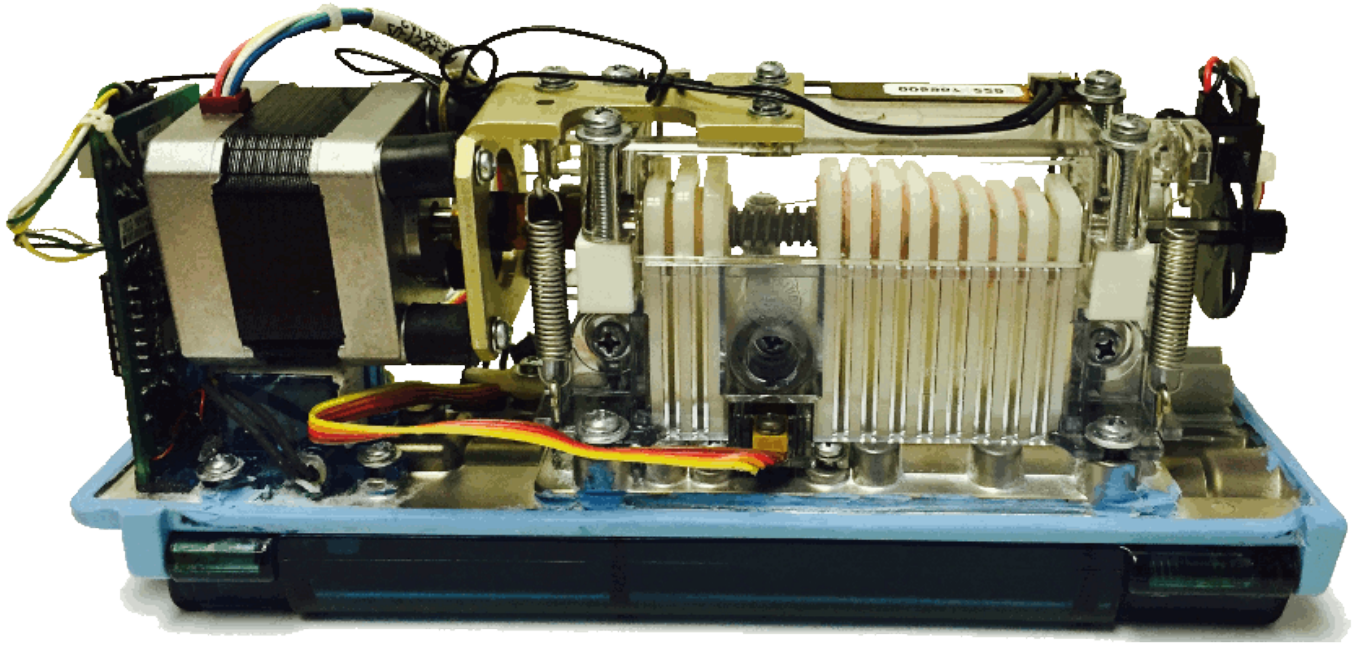
MATLAB EXPO 2016

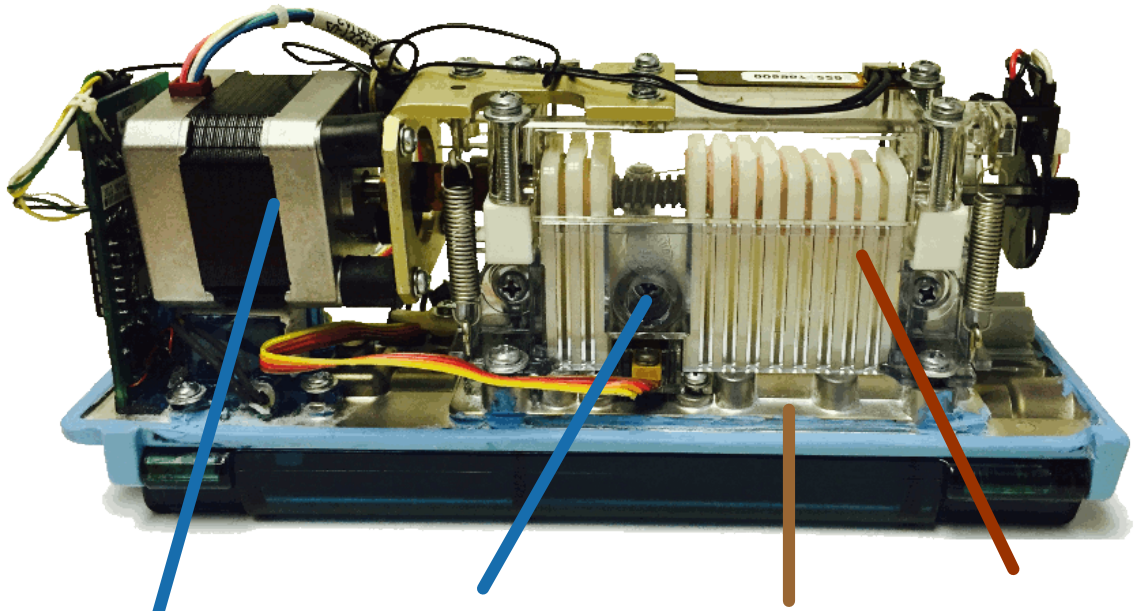
Effiziente Modellierung von elektrohydraulischen Systemen

By Manuel Fédou

Example: Linear Peristaltic Pump



Example: Linear Peristaltic Pump

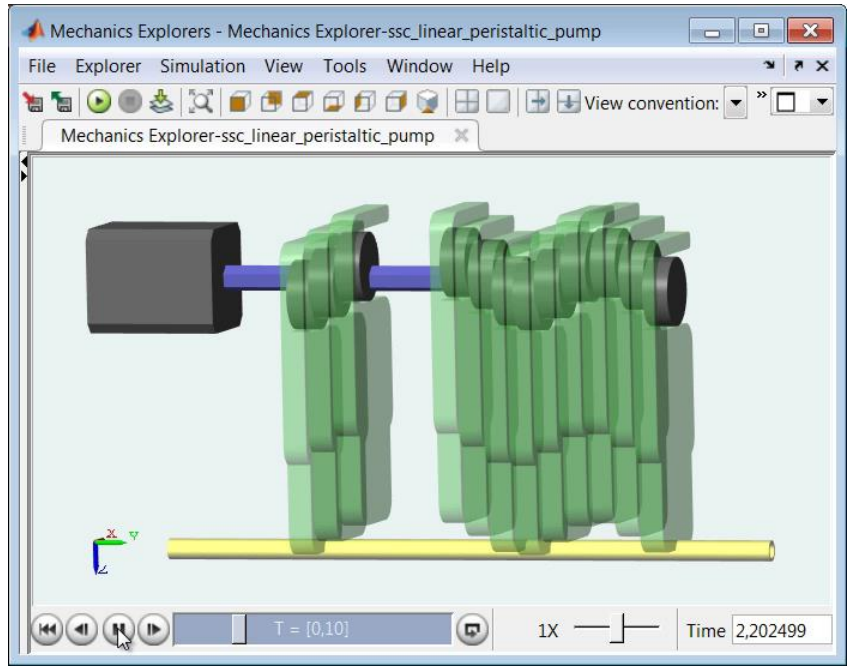


Electrical Motor

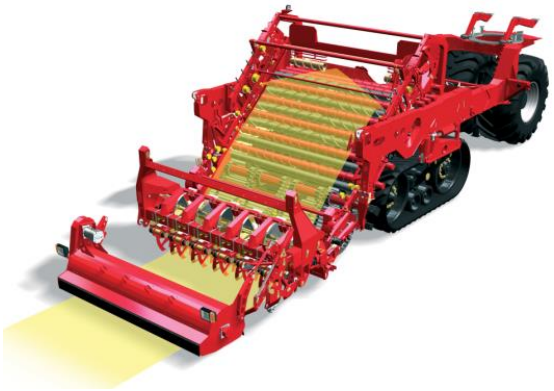
Electrical Pressure Sensor

Hydraulic Tubing

Mechanical Cam-Follower



Challenges of electro-hydraulic systems



Multi-domain systems

Increasing complexity

- Multiple teams involved
- Interaction between domains

Cost of Prototypes

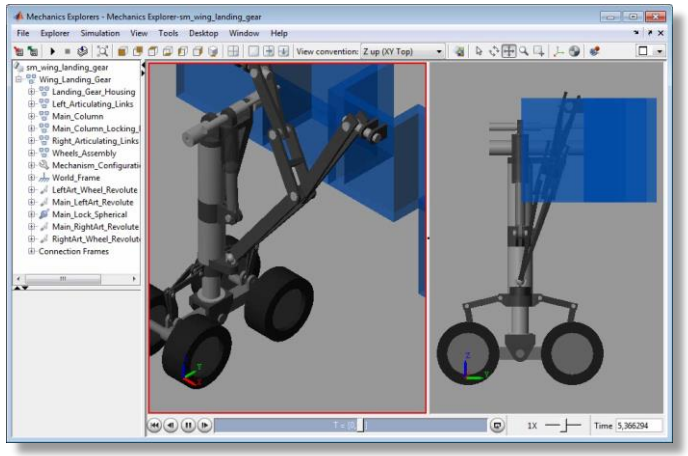
- Not always available
- Can break down

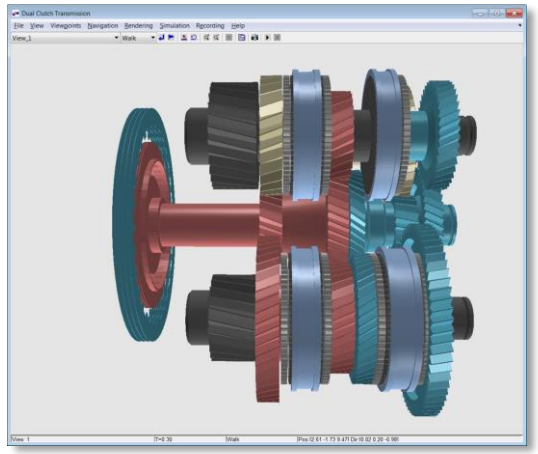
Test under hazardous conditions

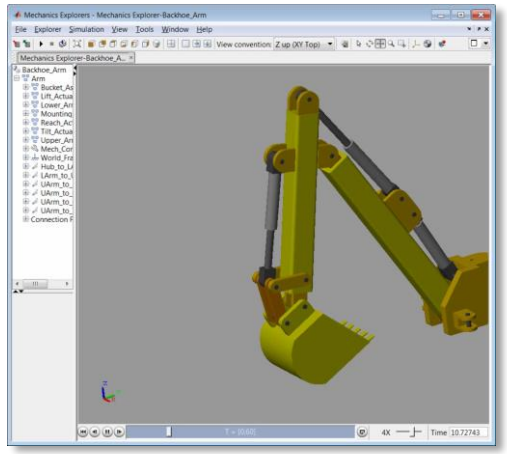
- Potentially dangerous for prototypes or engineers
- Not reproducible

What if you could?

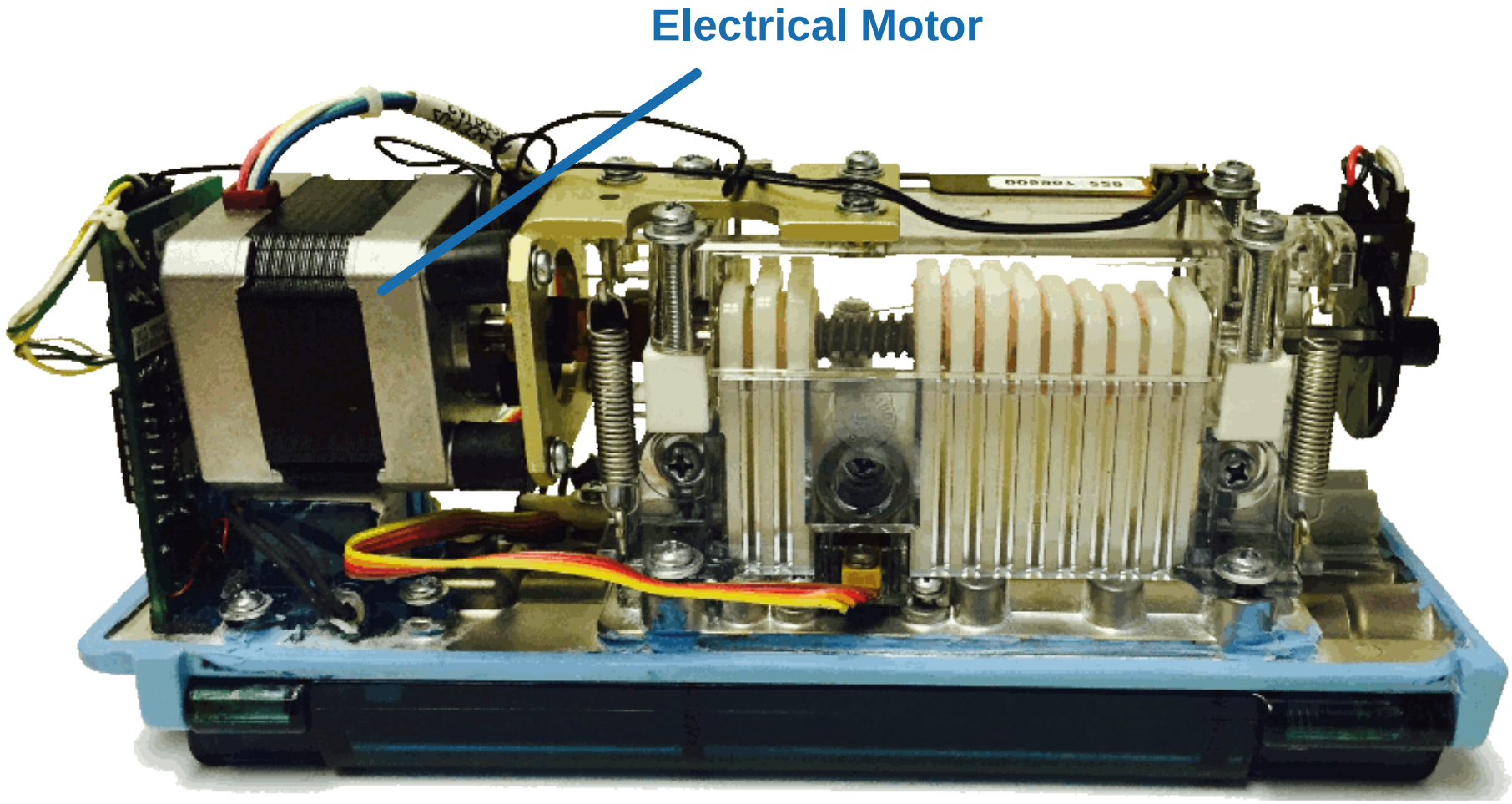
- Quickly create virtual prototypes to test your ideas
- Understand your physical system by simulation
- Design and test your software against accurate plant models
- Optimize system performance



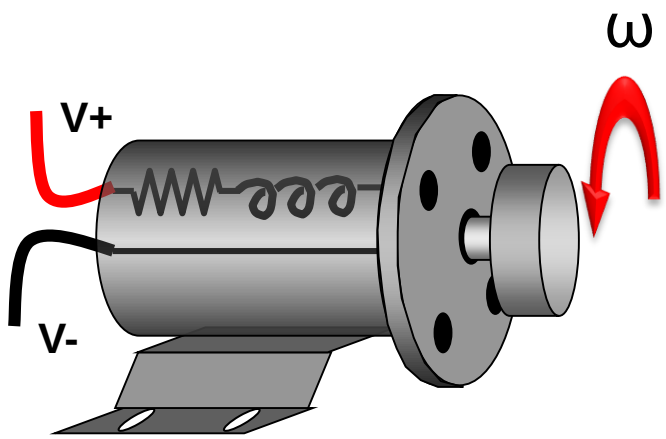




So where do we start?

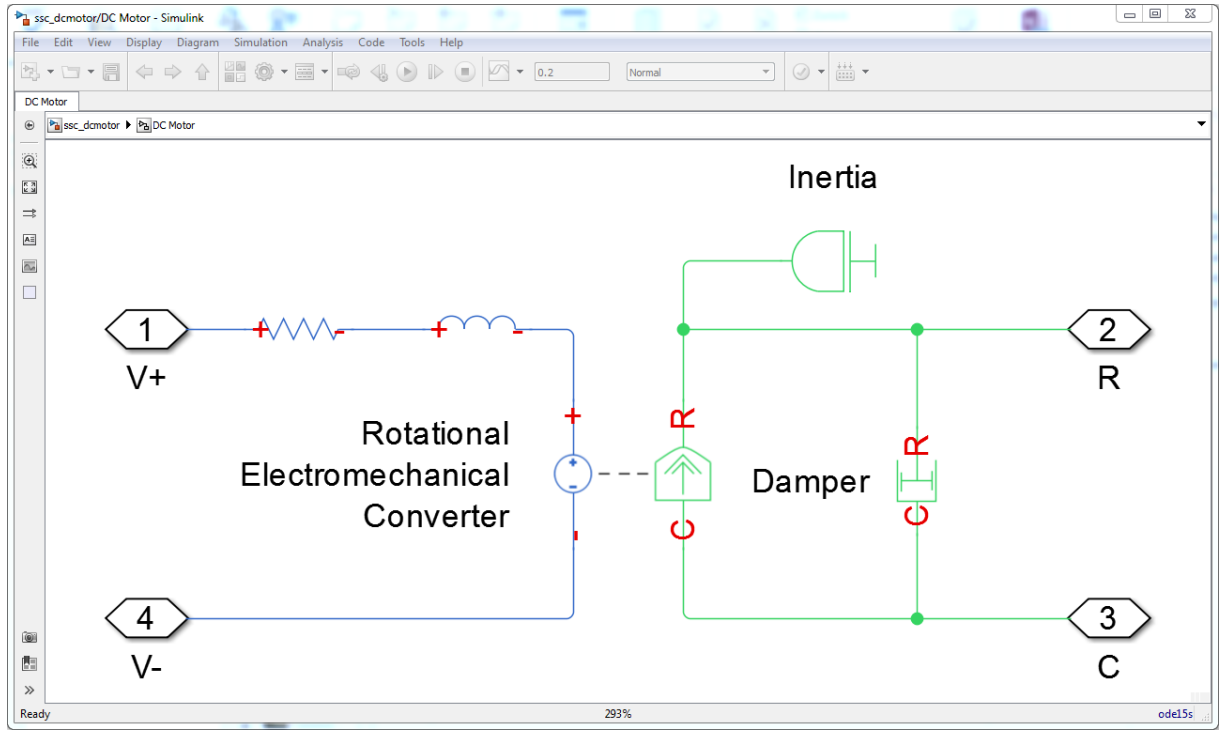


Electrical motor modeling



$$V_{in} = K_b\omega + i_m R_m + L_m \frac{di_m}{dt}$$

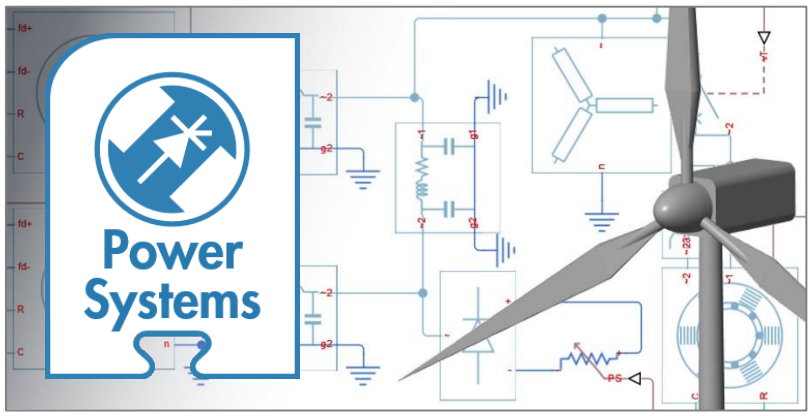
$$T = K_t i_m - D\omega - J\frac{d\omega}{dt}$$

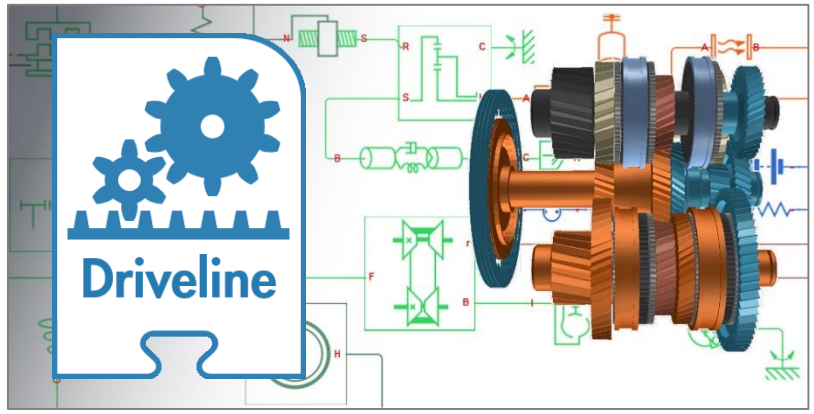


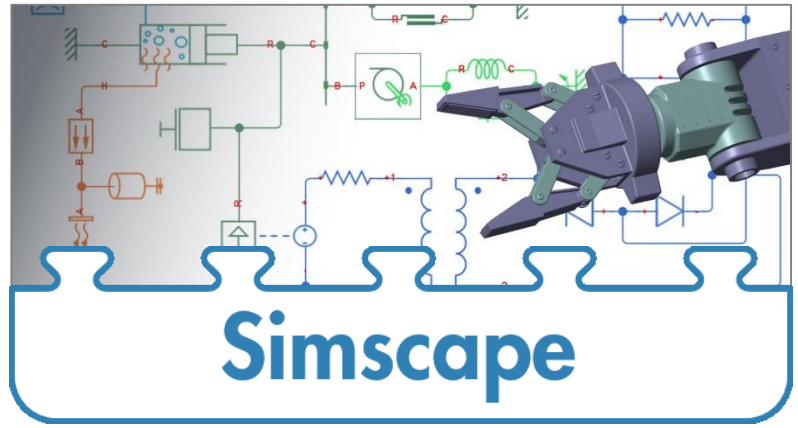
Simscape:

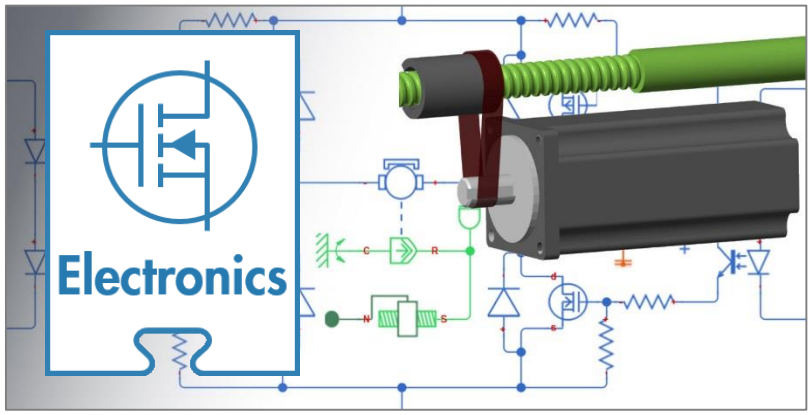
- Component-based
- Intuitive
- Easy to read

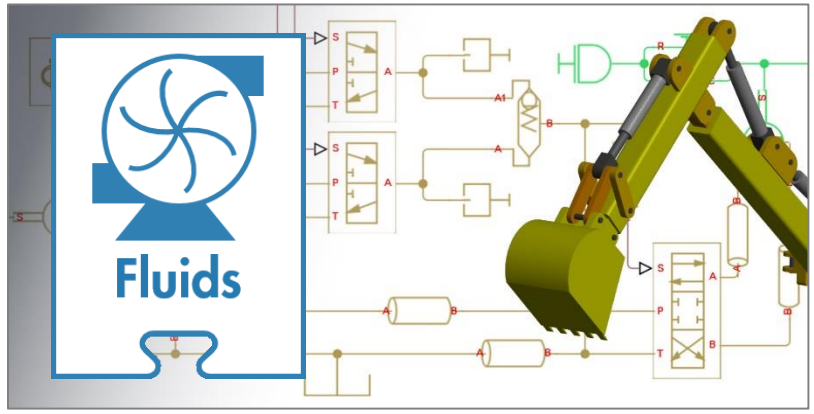
Physical Modelling with Simscape Products

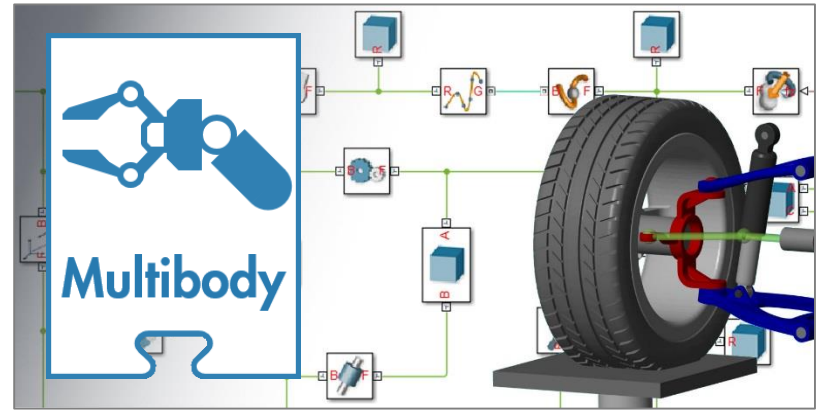




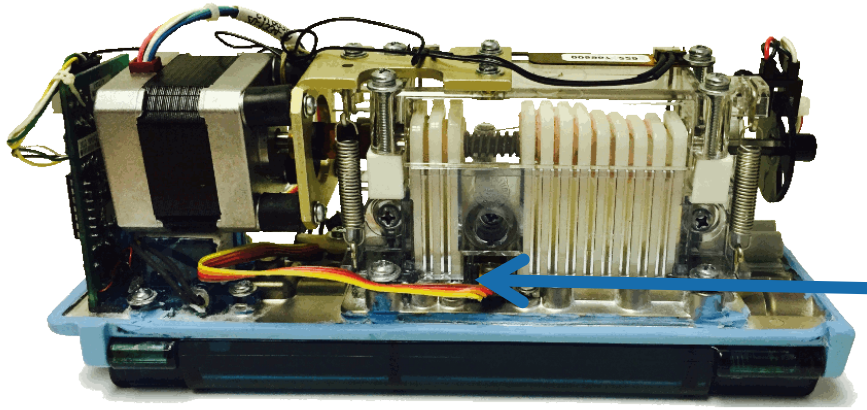


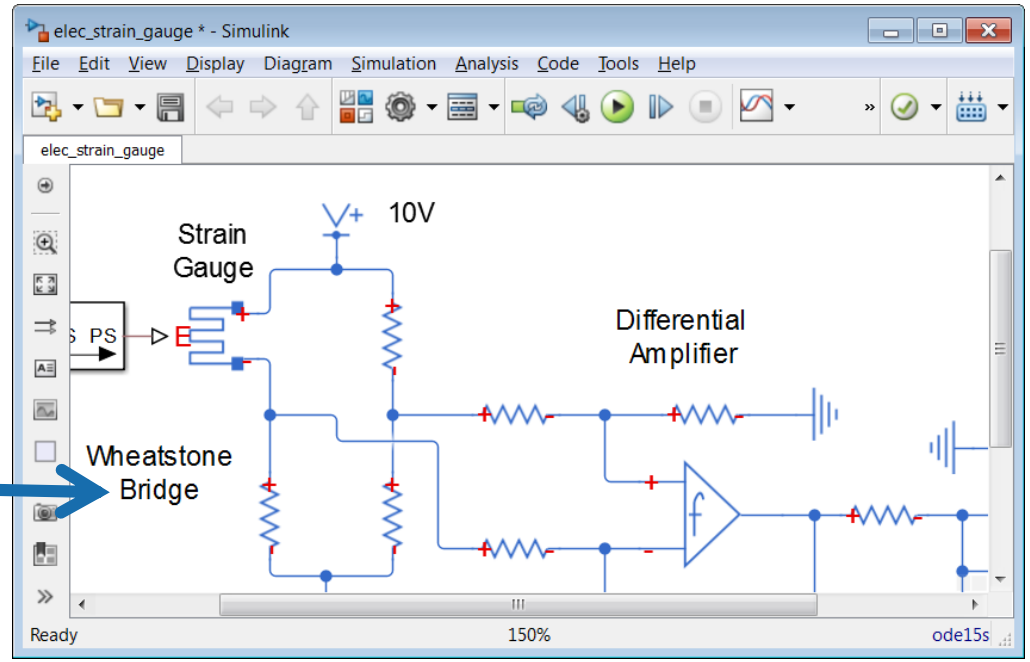


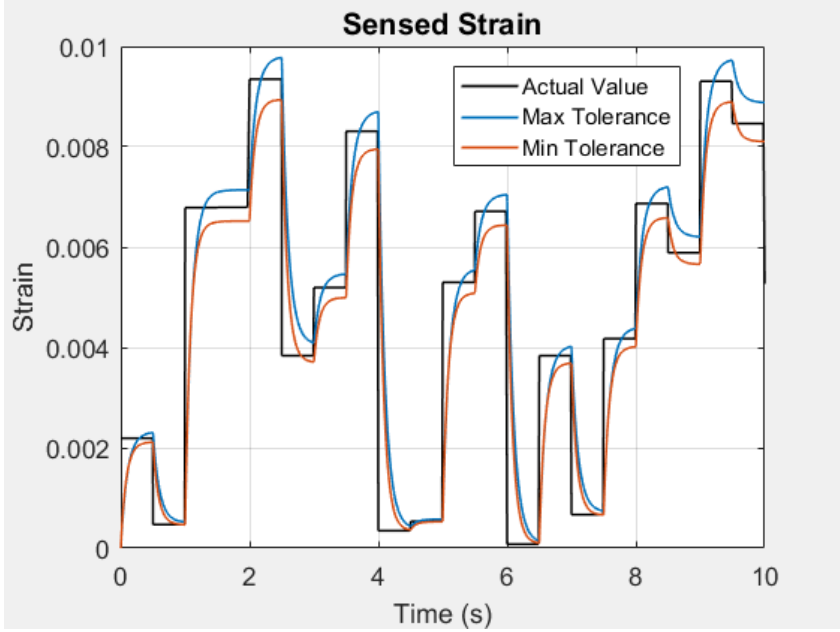




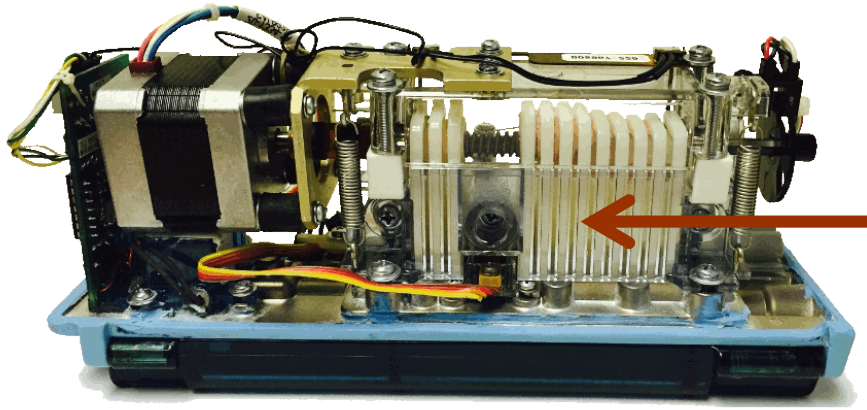
Pressure sensors

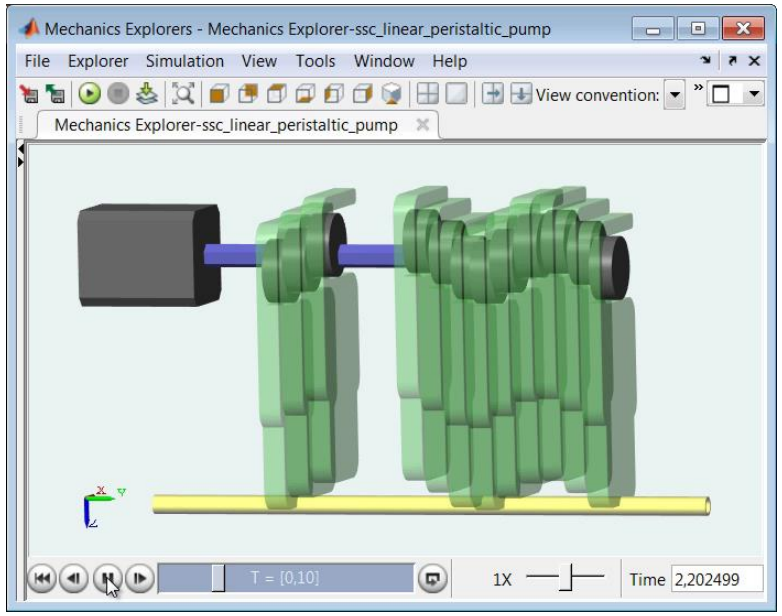


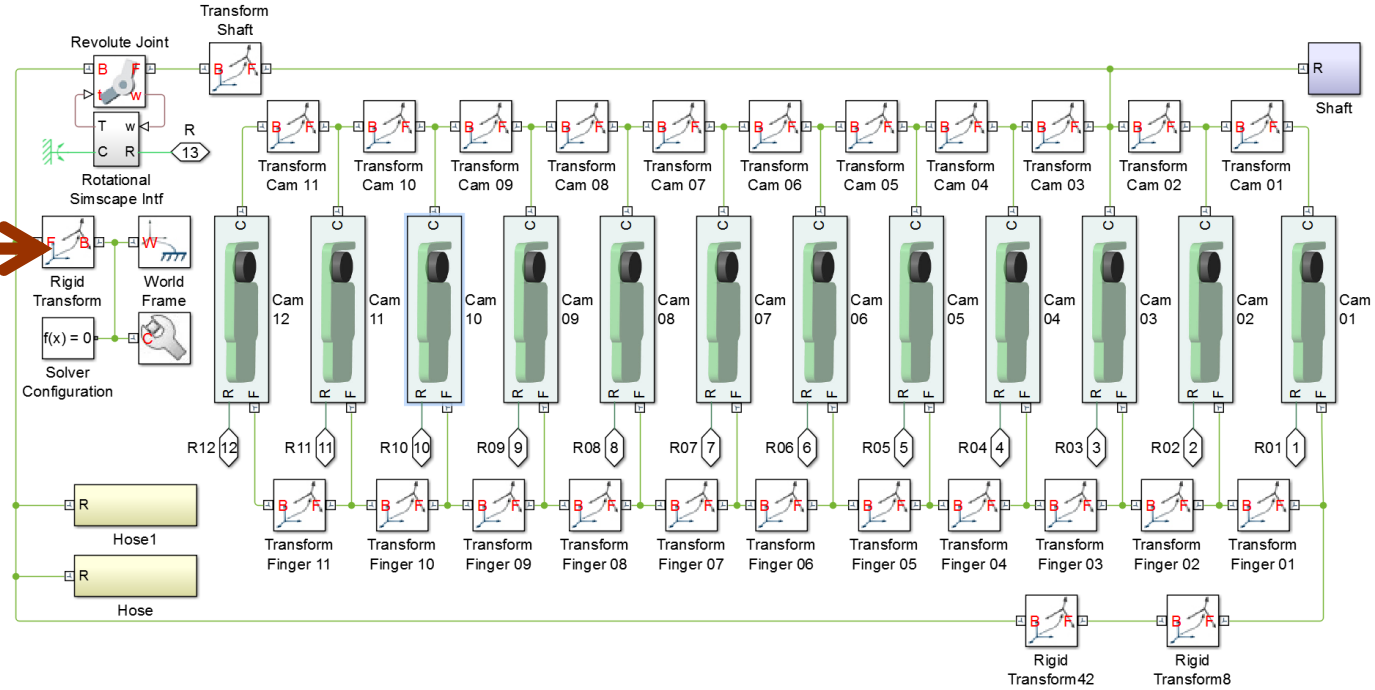




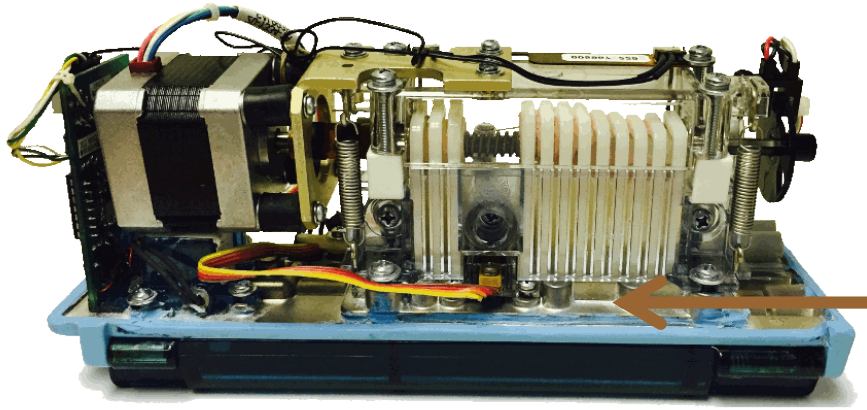
Mechanical Cam-Follower

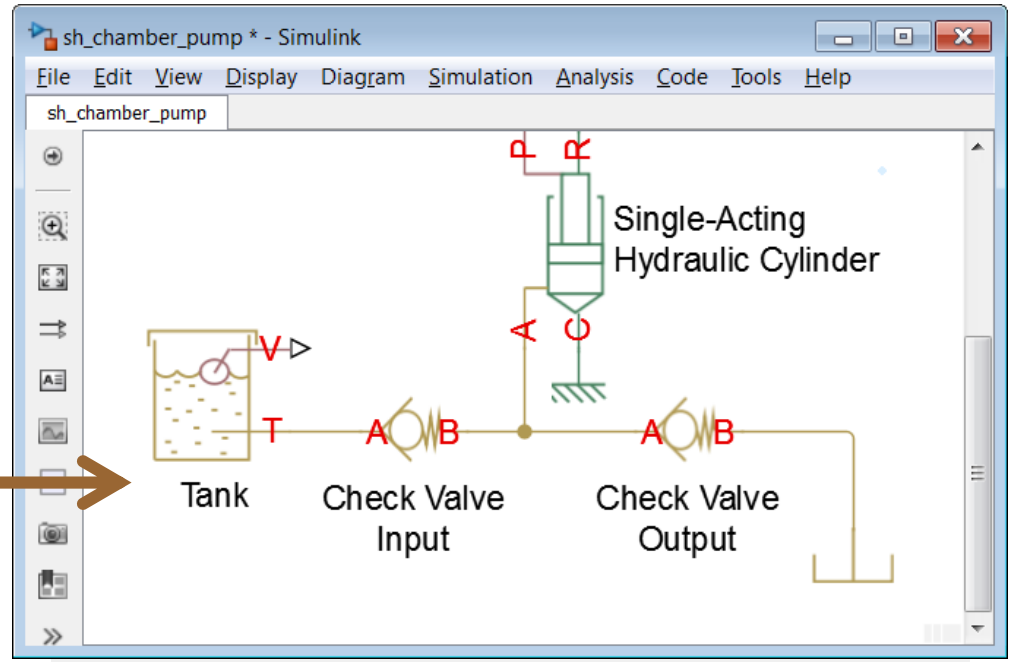


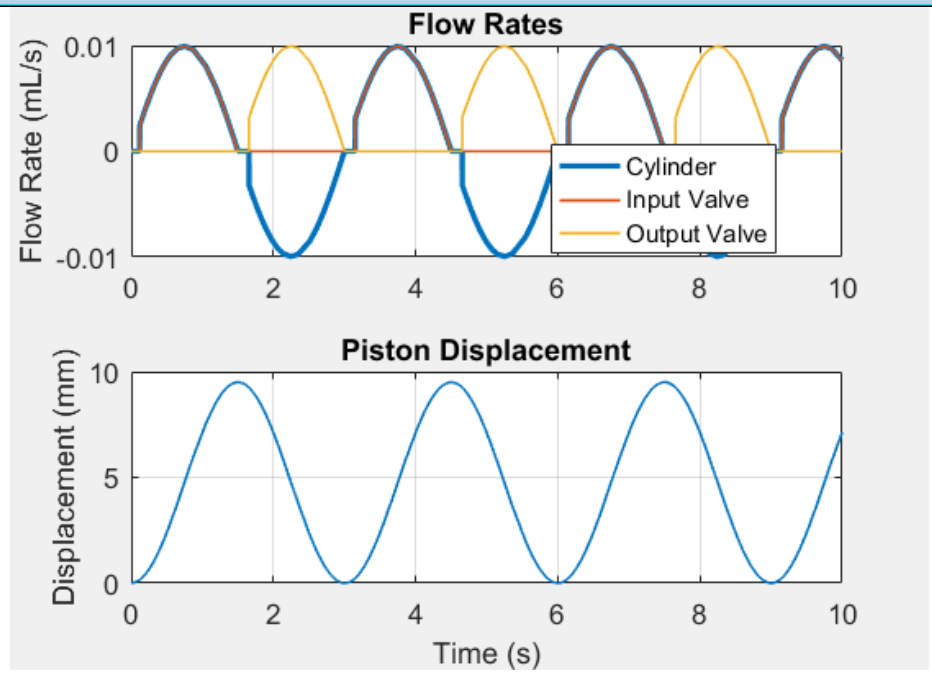




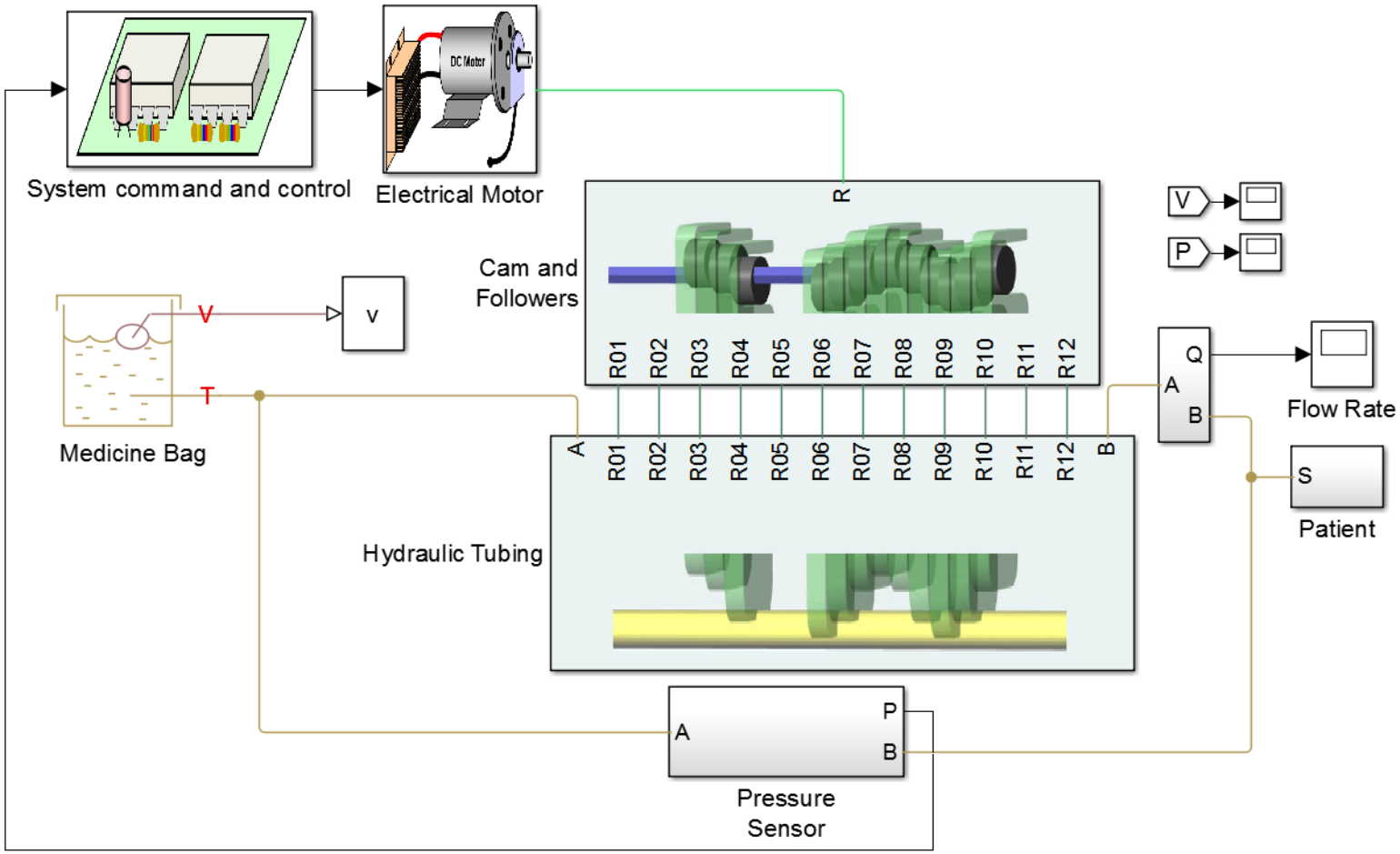
Hydraulic tubing

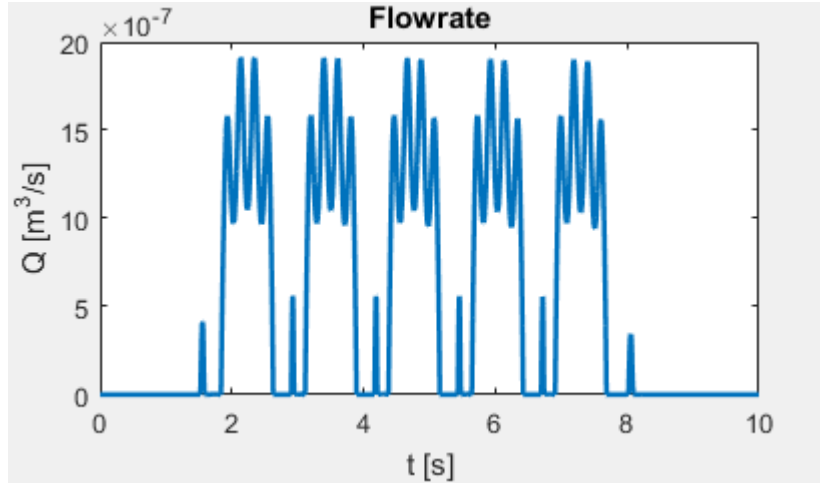


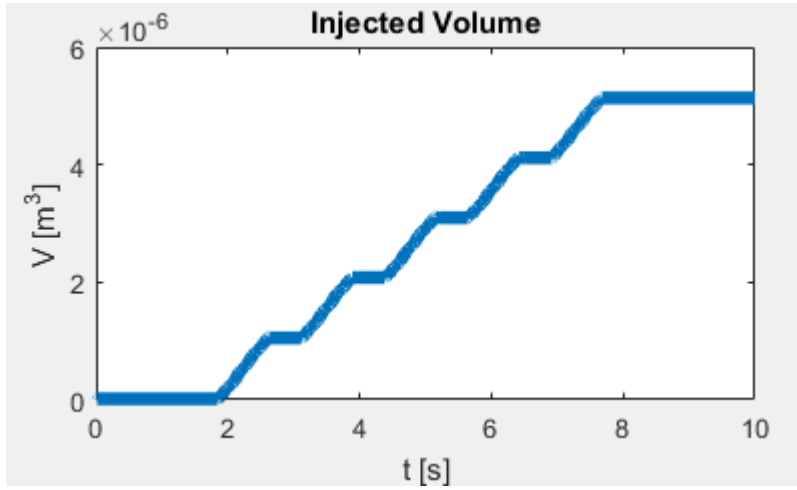




From components to fully integrated system model



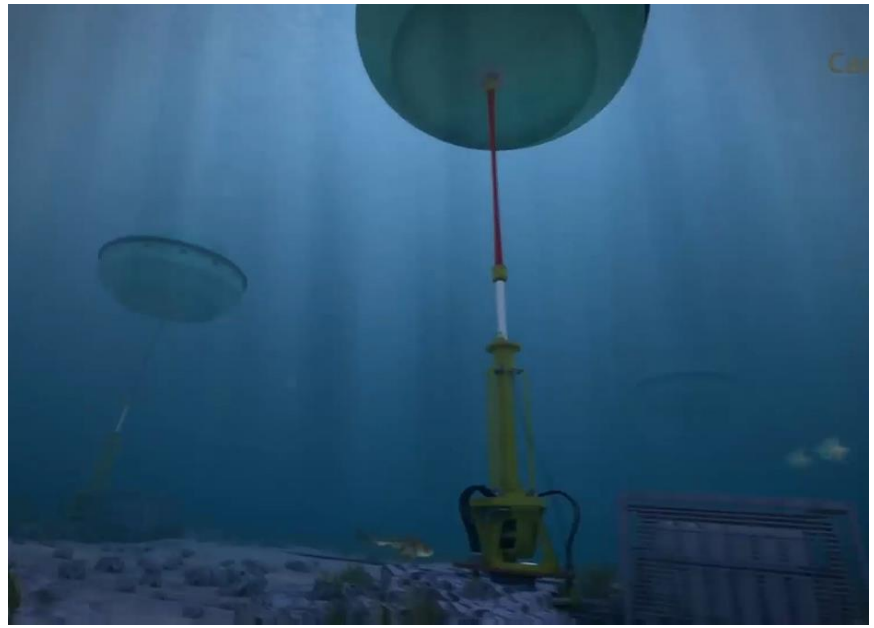




Carnegie Wave Energy

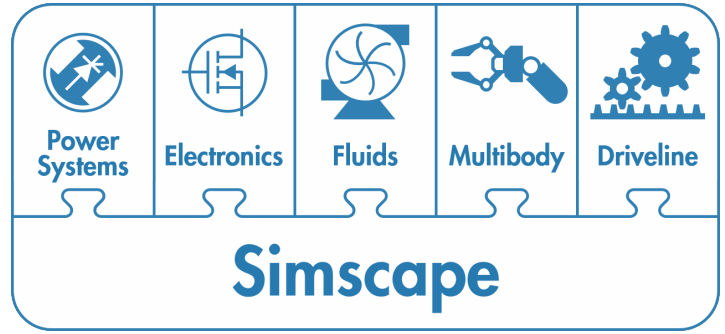
Carnegie Wave Energy Builds World's First Wave Energy Farm

- Scale testing minimized
- Crucial design insights gained
- Sensitivity studies accelerated



"*We can't afford the time and expense of building and analyzing multiple physical prototypes. Instead, we put the effort into* ***virtual prototyping*** *and getting the design right in Simulink.* ***Simulation reduces risk and fosters innovation*** *because we can use it to* ***quickly test novel ideas***."
–Jonathan Fiévez, Carnegie Wave Energy

Summary:



With Simscape, you can

- Quickly create virtual prototypes to test your ideas
- Understand your physical systems by simulation
- Design and test your software against accurate plant models
- Optimize system performance