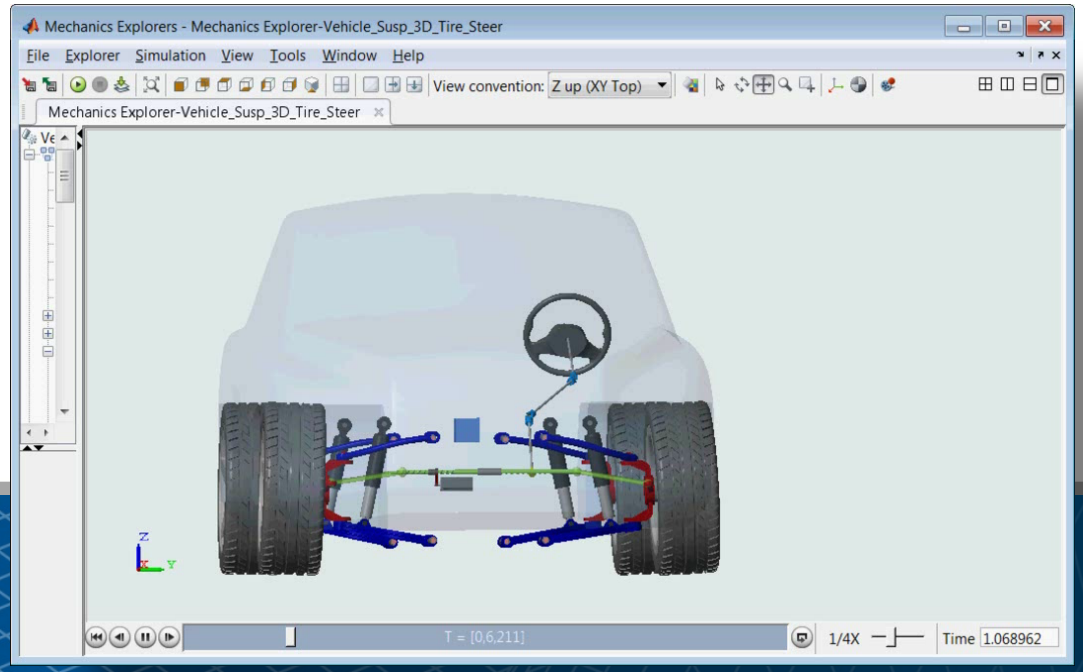
Simscape:
Reach for the Run Button

MathWorks
AUTOMOTIVE CONFERENCE 2015



Steve Miller

Technical Marketing, Simscape Products

http://www.mathworks.com/physical-modeling/

GM Milford Proving Ground

FG 94023

DRIVE ALL AREA TEMPORARY

NAME STEVE MILLER

REPRESENTING DELCO ELECTR

AUTHORIZED AREA VARIOUS

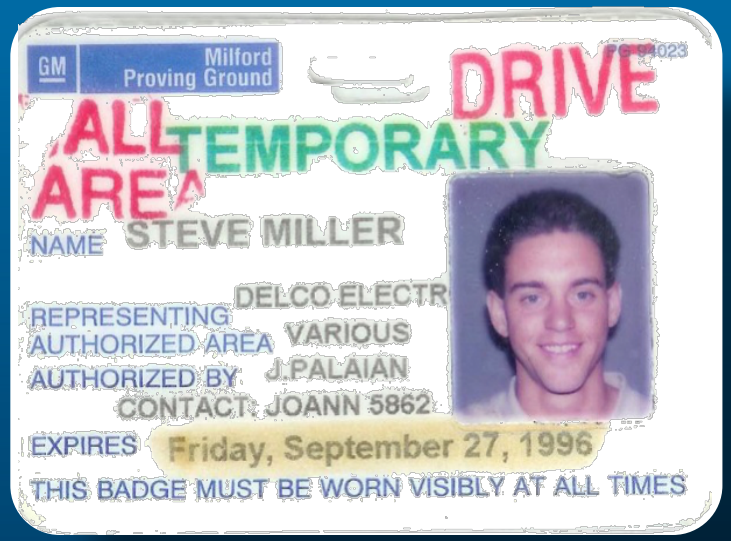
AUTHORIZED BY J.PALAIAN

CONTACT: JOANN 5862

EXPIRES Friday, September 27, 1996

THIS BADGE MUST BE WORN VISIBLY AT ALL TIMES


fun
inefficient


GM
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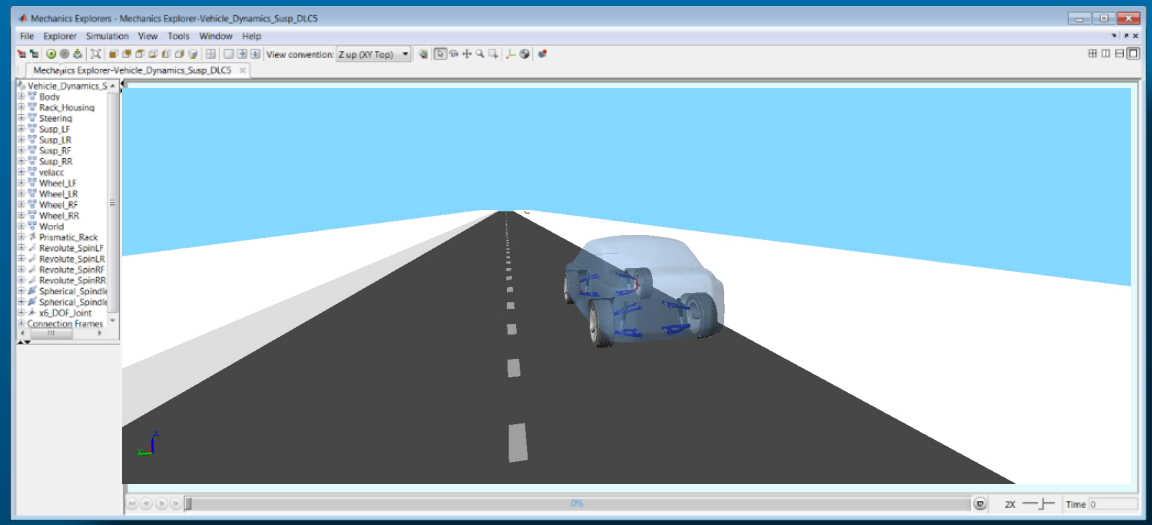

Mechanics Explorers - Mechanics Explorer-Vehicle_Dynamics_Susp_DLC5
File Explorer Simulation View Tools Window Help
View convention: Z up (XY Top)
Mechanics Explorer-Vehicle_Dynamics_Susp_DLC5
Vehicle_Dynamics_S
Body
Rack_Housing
Steering
Susp_LF
Susp_LR
Susp_RF
Susp_RR
velacc
Wheel_LF
Wheel_LR
Wheel_RF
Wheel_RR
World
Prismatic_Rack
RevoluteSpinLF
RevoluteSpinLR
RevoluteSpinRF
RevoluteSpinRR
Spherical_Spindle
Spherical_Spindle
x6_DOF_Joint
Connection Frames
0%
ZX
Time 0

Simscape

+

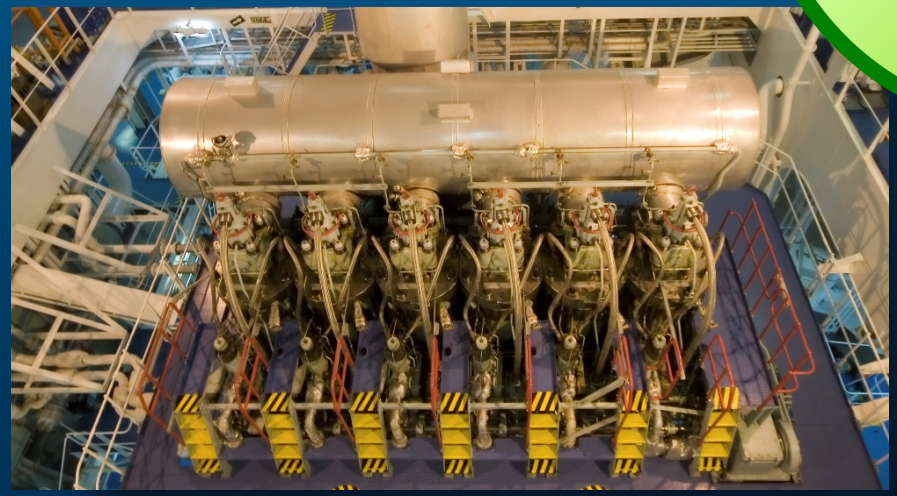
MATLAB &
Simulink

=

system is

too big

Power In ower Out



conditions are

too difficult

only get

one chance

Courtesy NASA/JPL-Caltech

too big

USER STORY

ABB Optimizes Ship Energy Flows

too difficult

USER STORY

DCNS Simulates Handling System

one chance

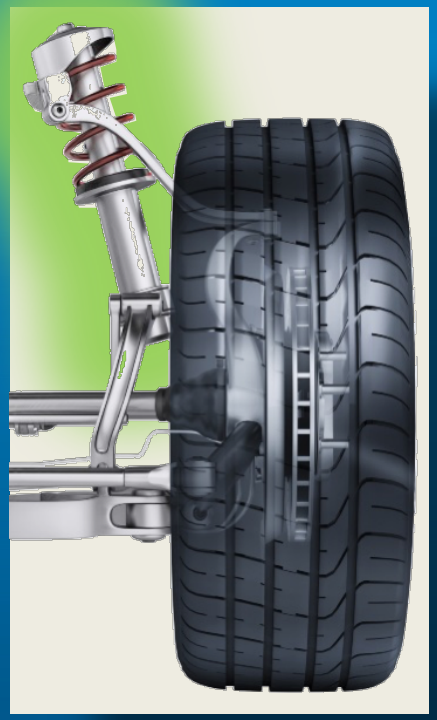
USER STORY

Lockheed Martin Develops MRO

Courtesy NASA/JPL-Caltech

Why use Simscape?

Makes modeling easy



Simscape **handles equations automatically**

$$F_{Spring} = k_{Spring} * (z_{Car})$$

$$F_{Shock} = b_{Shock} * \left(\frac{dz_{Car}}{dt}\right)$$

$$\frac{d^2 z_{Car}}{dt^2} = \frac{-F_{Spring} - F_{Shock}}{m_{Car}}$$

Simulink

Simscape

Simscape handles equations automatically

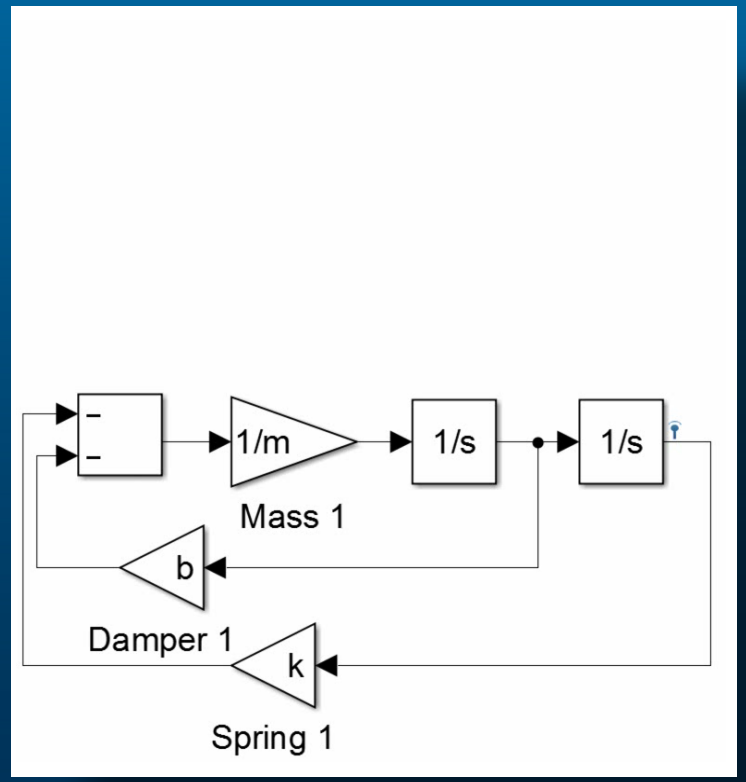
$$F_{Spring} = k_{Spring} * (z_{Car} - z_{Whl})$$

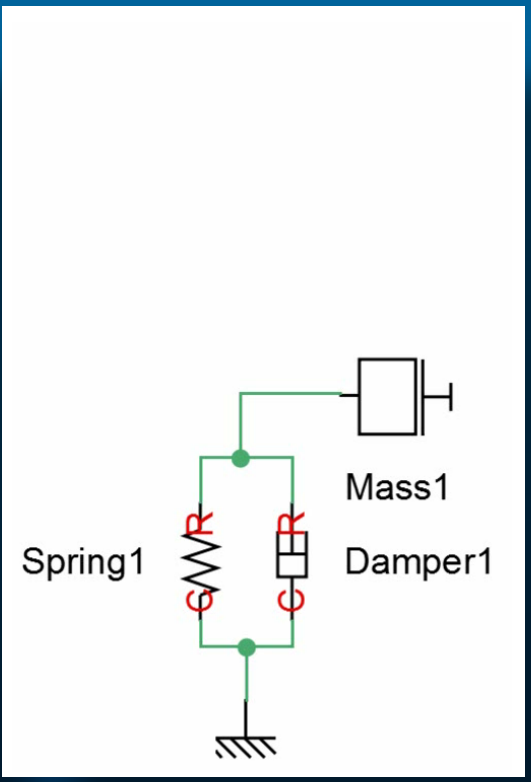
$$F_{Shock} = b_{Shock} * (\frac{dz_{Car}}{dt} - \frac{dz_{Whl}}{dt})$$

$$\frac{d^2 z_{Car}}{dt^2} = \frac{-F_{Spring} - F_{Shock}}{m_{Car}}$$

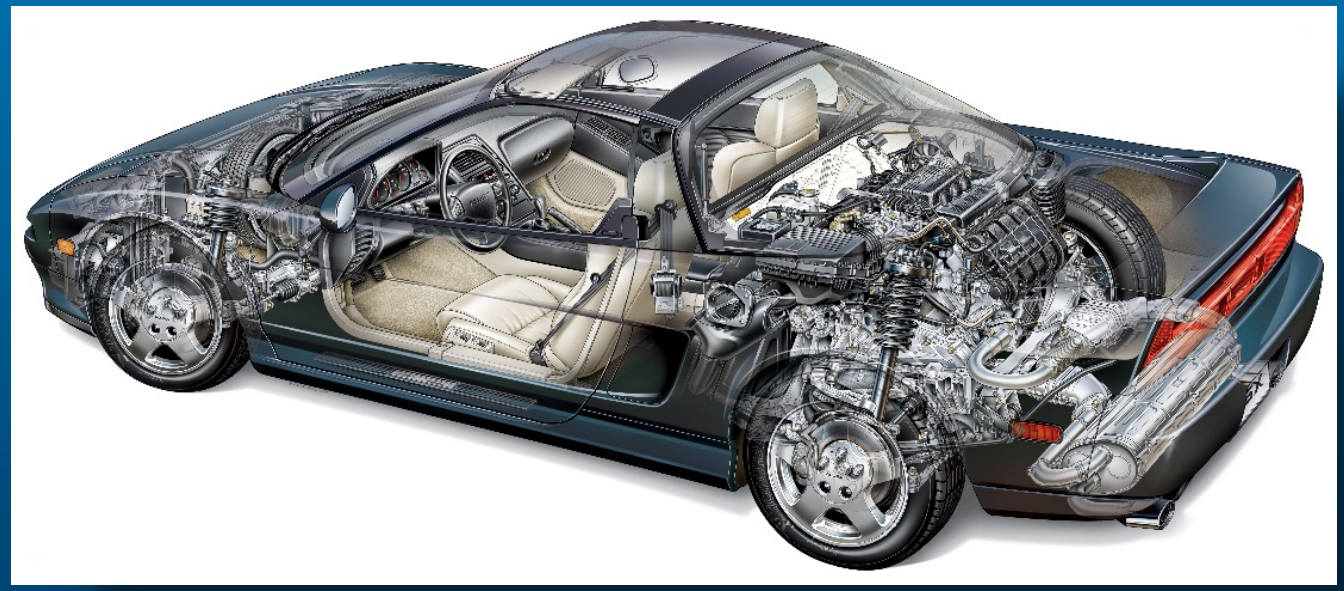
$$F_{Tire} = k_{Tire} * (z_{Whl}) + b_{Tire} * (\frac{dz_{Car}}{dt})$$

$$\frac{d^2 z_{Whl}}{dt^2} = \frac{F_{Spring} + F_{Shock} - F_{Tire}}{m_{Car}}$$

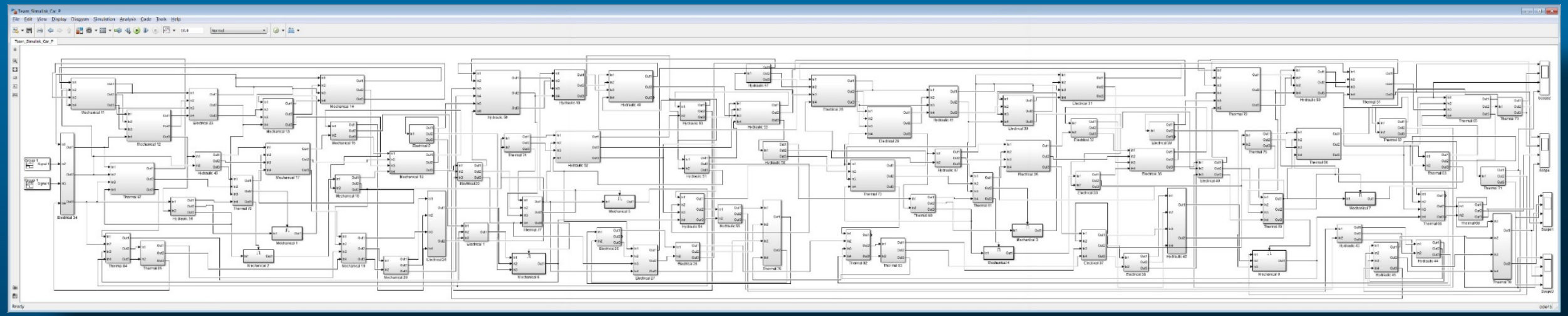


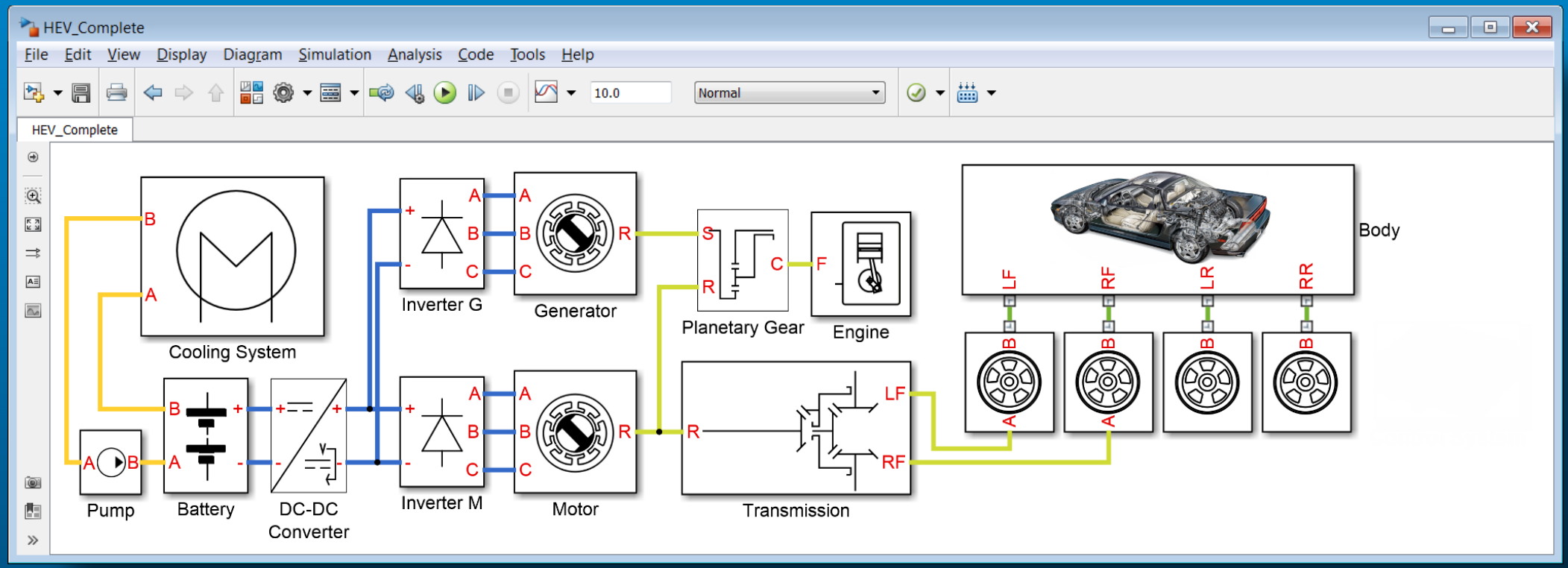


3D mechanics
hybrid powertrain



power steering
air conditioning


Team_Simulink_Car_P
File Edit View Display Diagram Simulation Analysis Code Tools Help
Ready

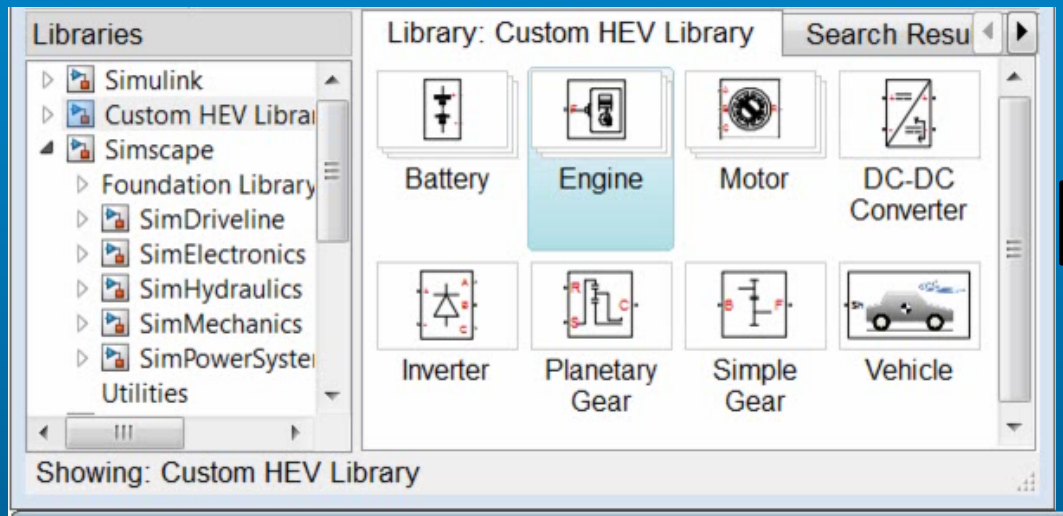


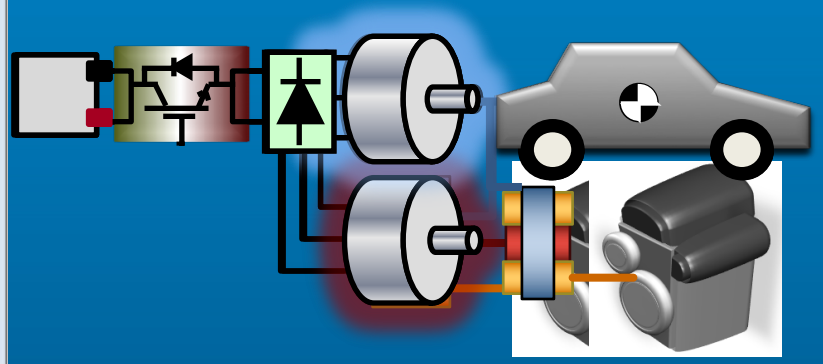
electrical

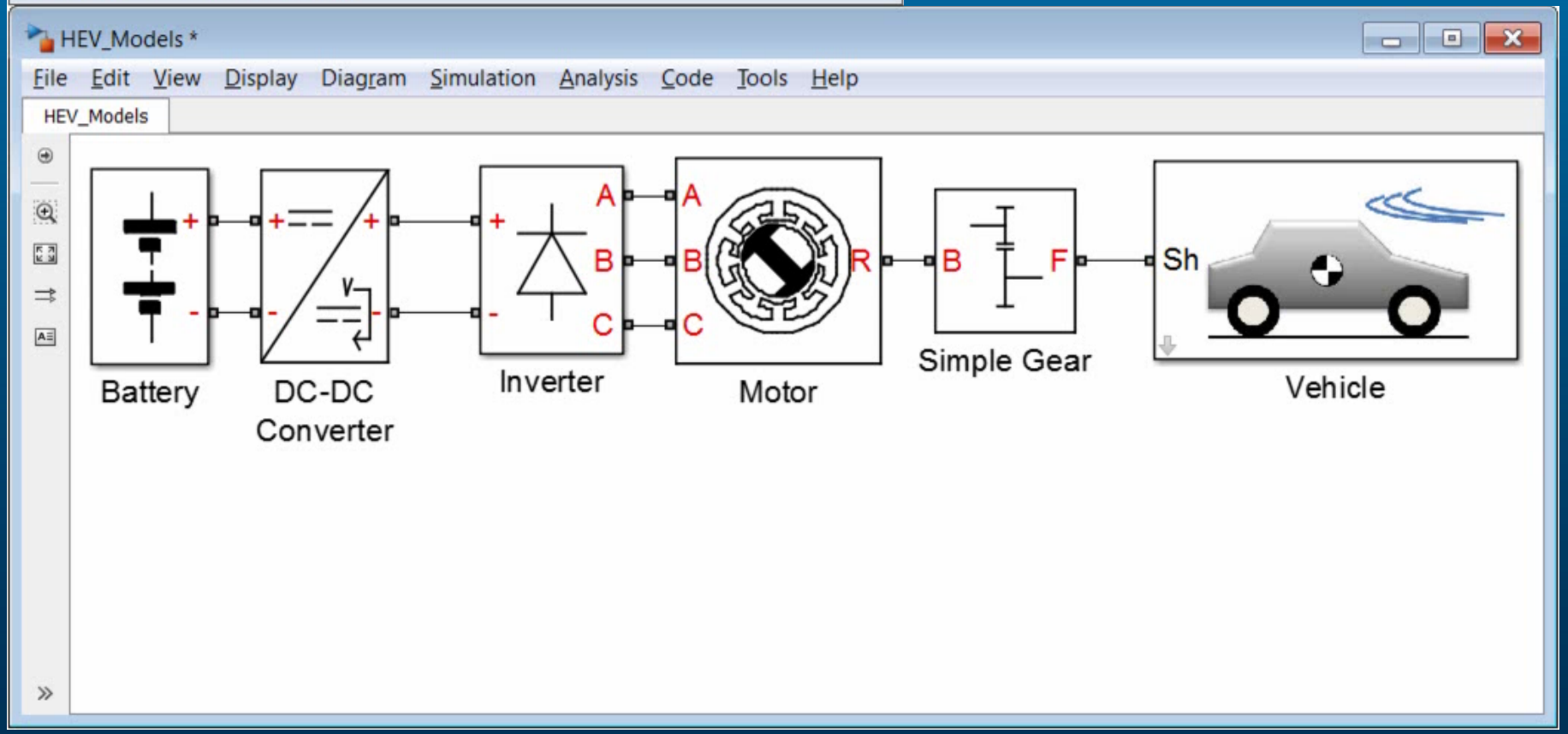
mechanical

hydraulic

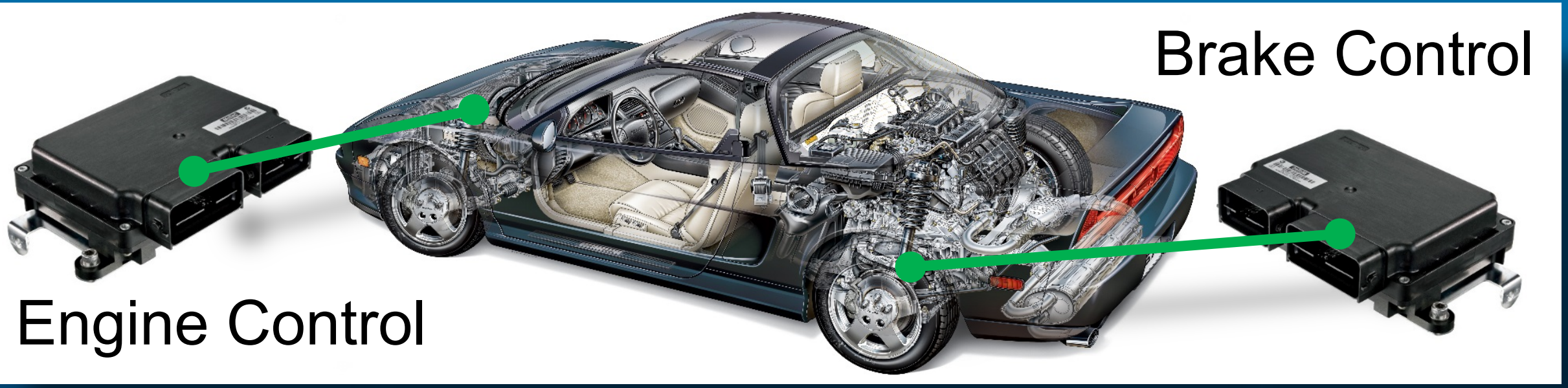
less clicking more simulating

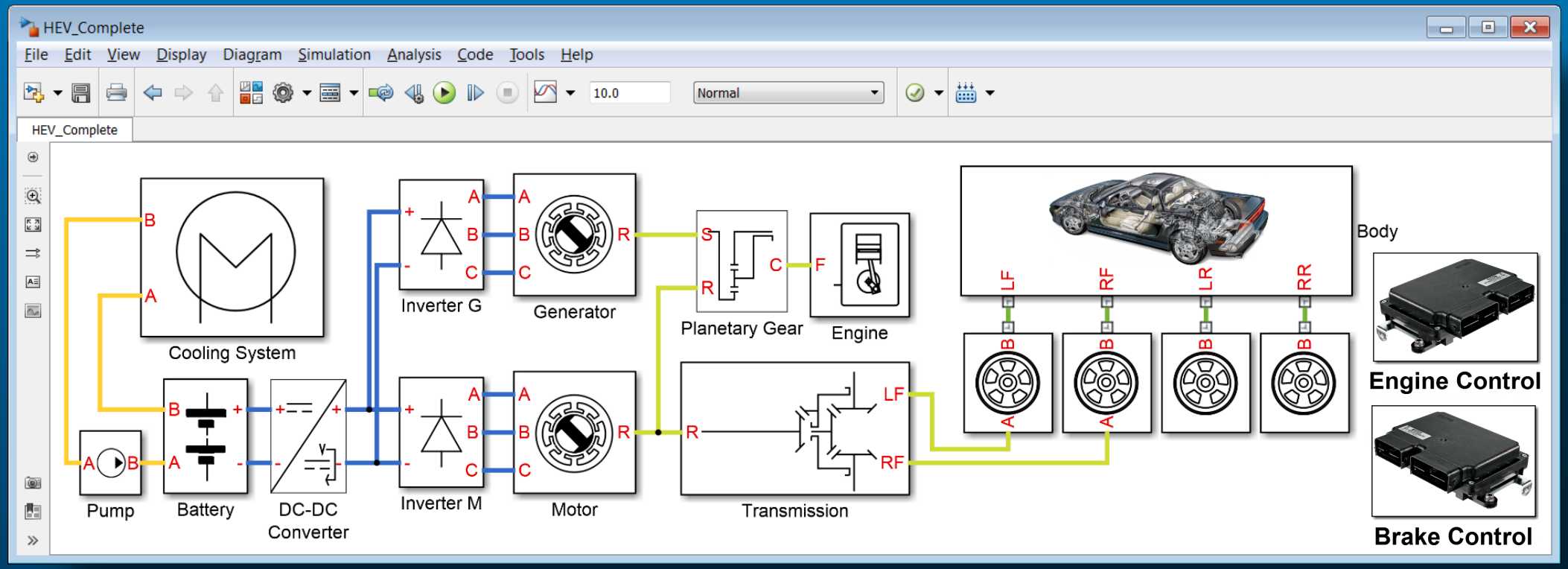

Libraries
Simulink
Custom HEV Libra
Simscape
Foundation Library
SimDriveline
SimElectronics
SimHydraulics
SimMechanics
SimPowerSyste
Utilities
Library: Custom HEV Library
Search Resu
Battery
Engine
Motor
DC-DC Converter
Inverter
Planetary Gear
Simple Gear
Vehicle
Showing: Custom HEV Library

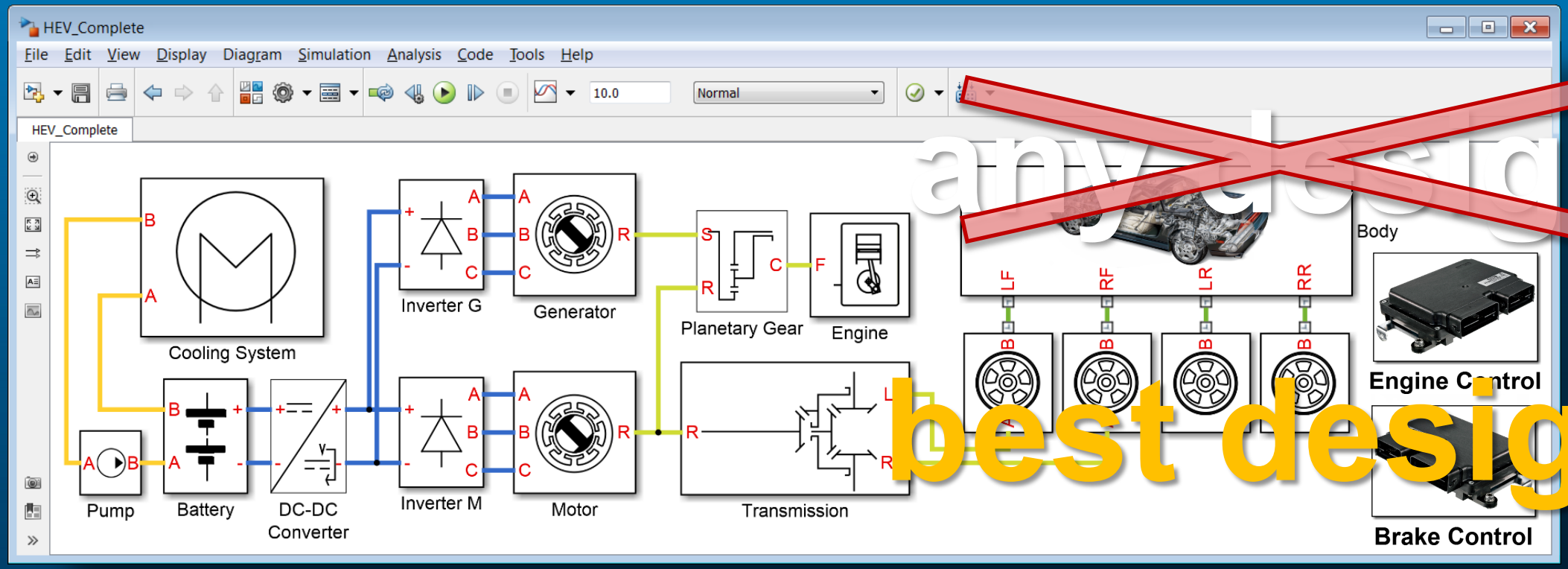



HEV_Models *
File Edit View Display Diagram Simulation Analysis Code Tools Help
HEV_Models
Battery
DC-DC Converter
Inverter
Motor
Simple Gear
Sh
Vehicle

Simscape + MATLAB & Simulink


Brake Control
Engine Control


HEV_Complete
File Edit View Display Diagram Simulation Analysis Code Tools Help
10.0
Normal
HEV_Complete
Cooling System
Inverter G
Generator
Planetary Gear
Engine
Body
LF
RF
LR
RR
Engine Control
Pump
Battery
DC-DC Converter
Inverter M
Motor
Transmission
Brake Control


HEV_Complete
File Edit View Display Diagram Simulation Analysis Code Tools Help
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Normal
HEV_Complete
Cooling System
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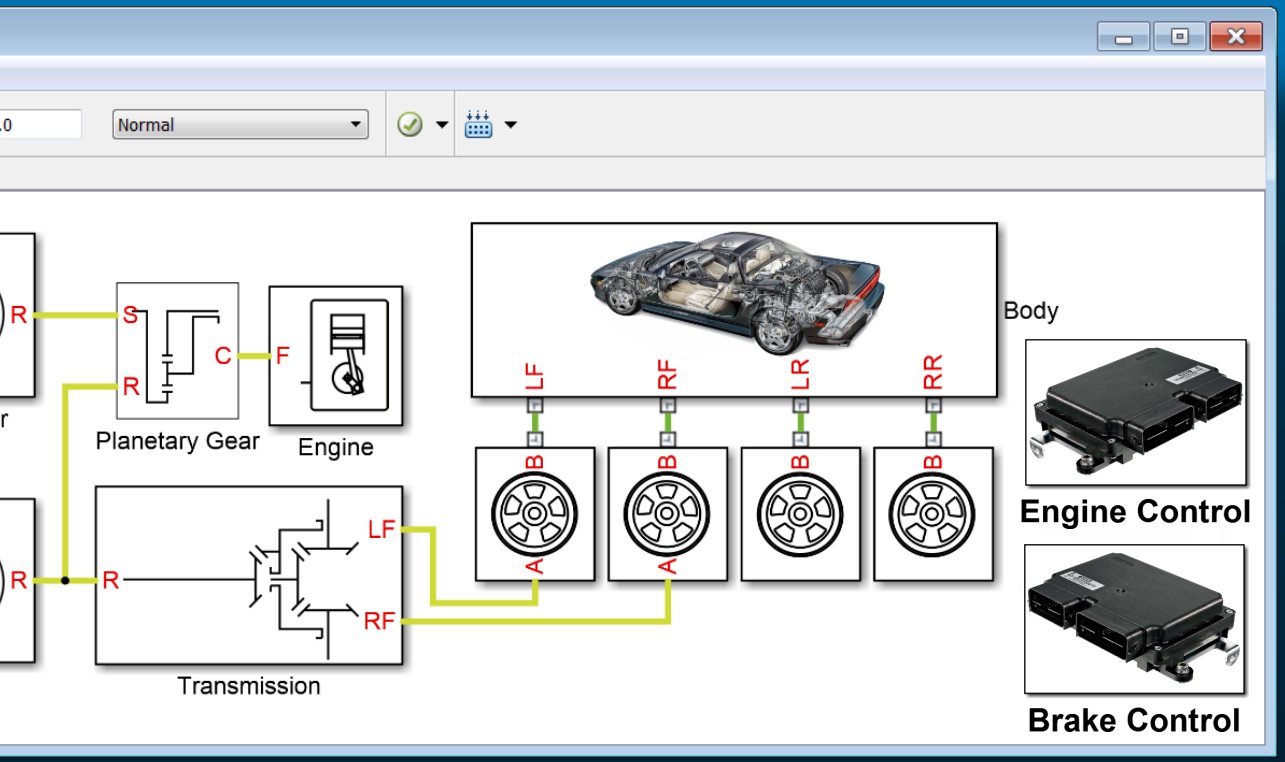
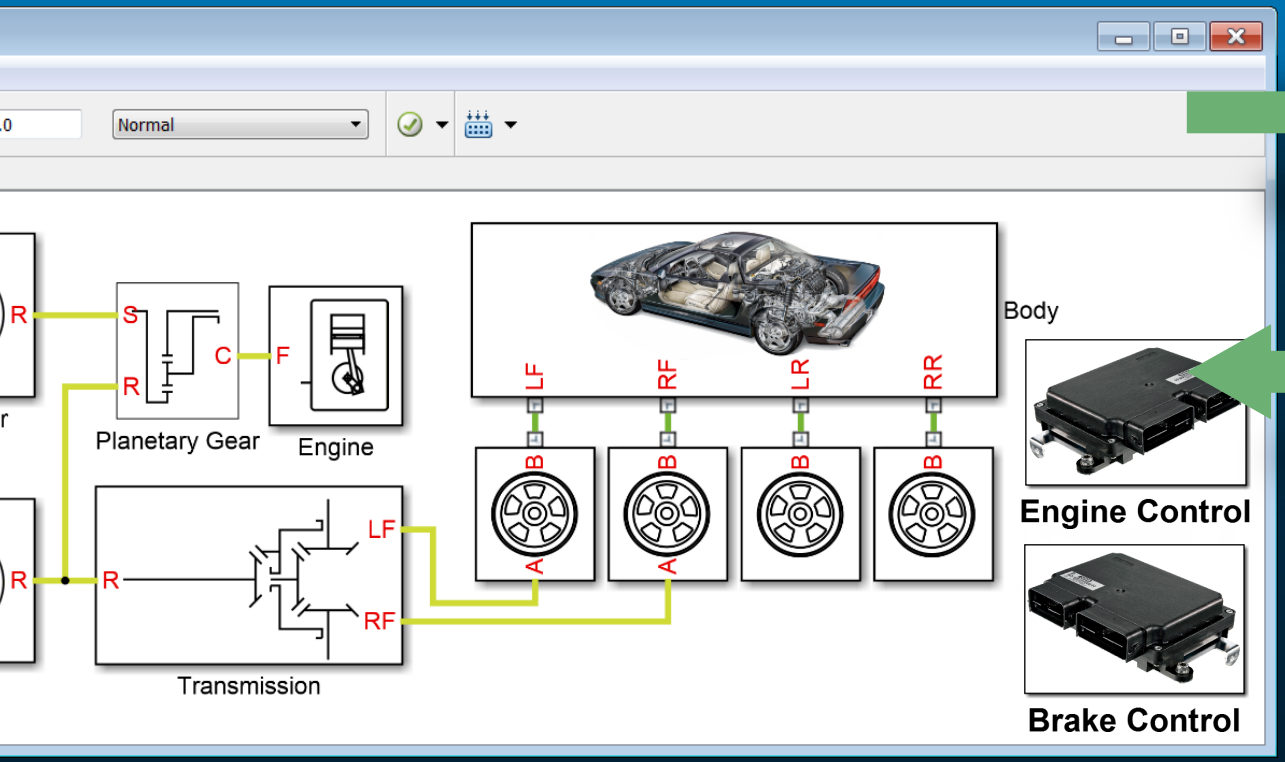
Engine
Pump
Battery
DC-DC Converter
Inverter M
Motor
Transmission
Body
LF
RF
LR
RR
Engine Control
Brake Control
any design
best design


Normal
R
S
R
C
F
Planetary Gear
Engine
LF
RF
LR
RR
B
A
Body
Engine Control
R
LF
RF
Transmission
Brake Control



optimize

to find the

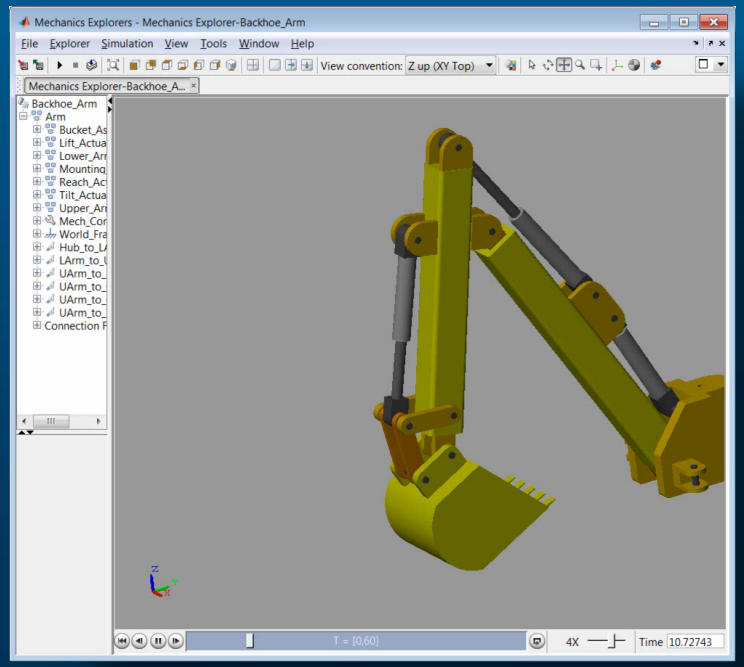
best design

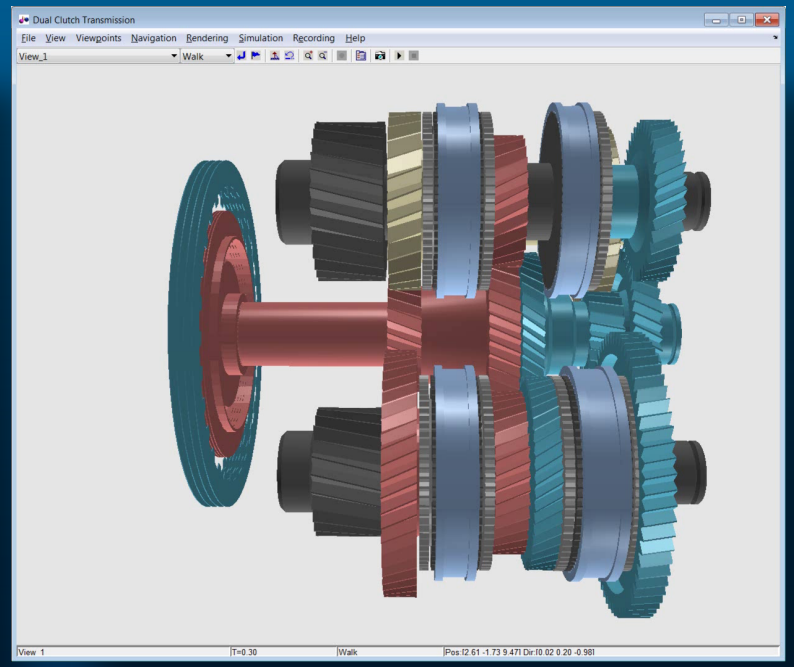
Market Demand:

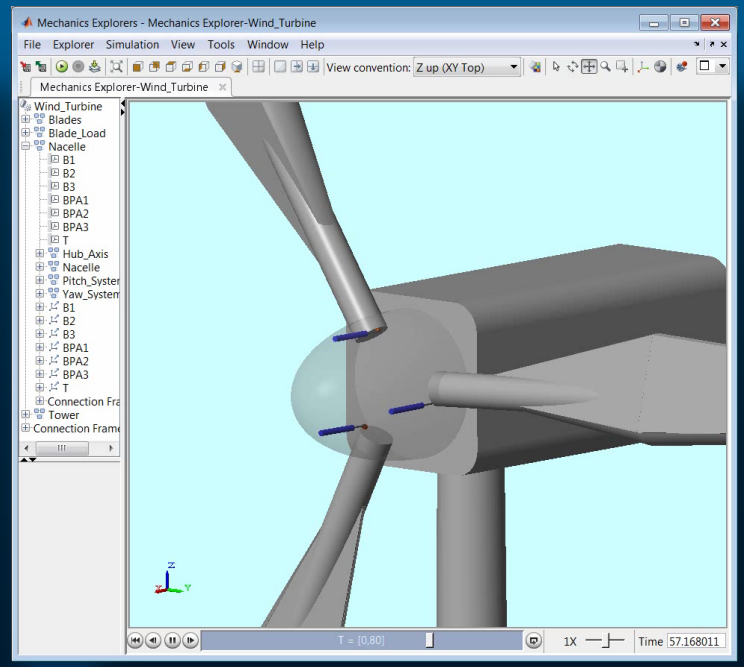
Reduce energy consumption in integrated systems

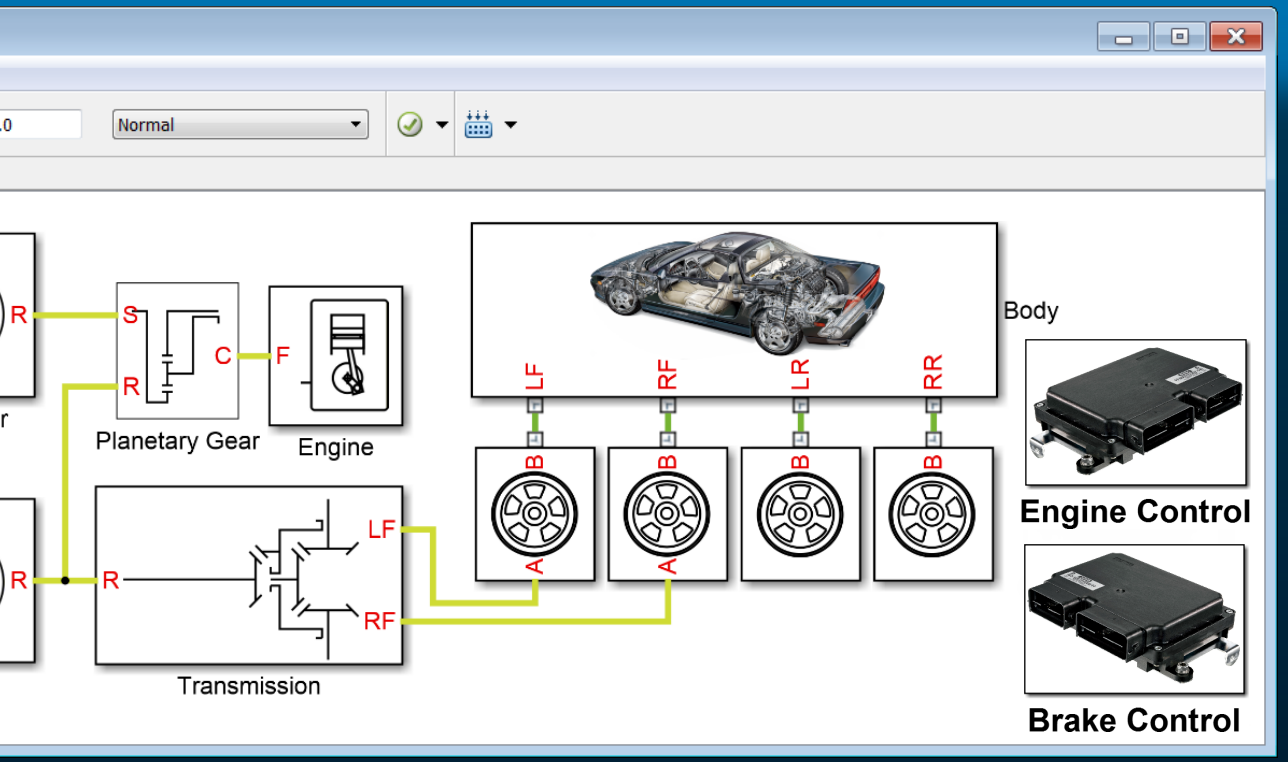
Simscape Focus:

Domain integration
Algorithm design
Optimization









Why model the physical system?

Too big, too difficult, one chance, …

Why Simscape?

Makes modeling easy

Develop controller

Find best design


Mechanics Explorers - Mechanics Explorer-Vehicle_Dynamics_Susp_DLC5
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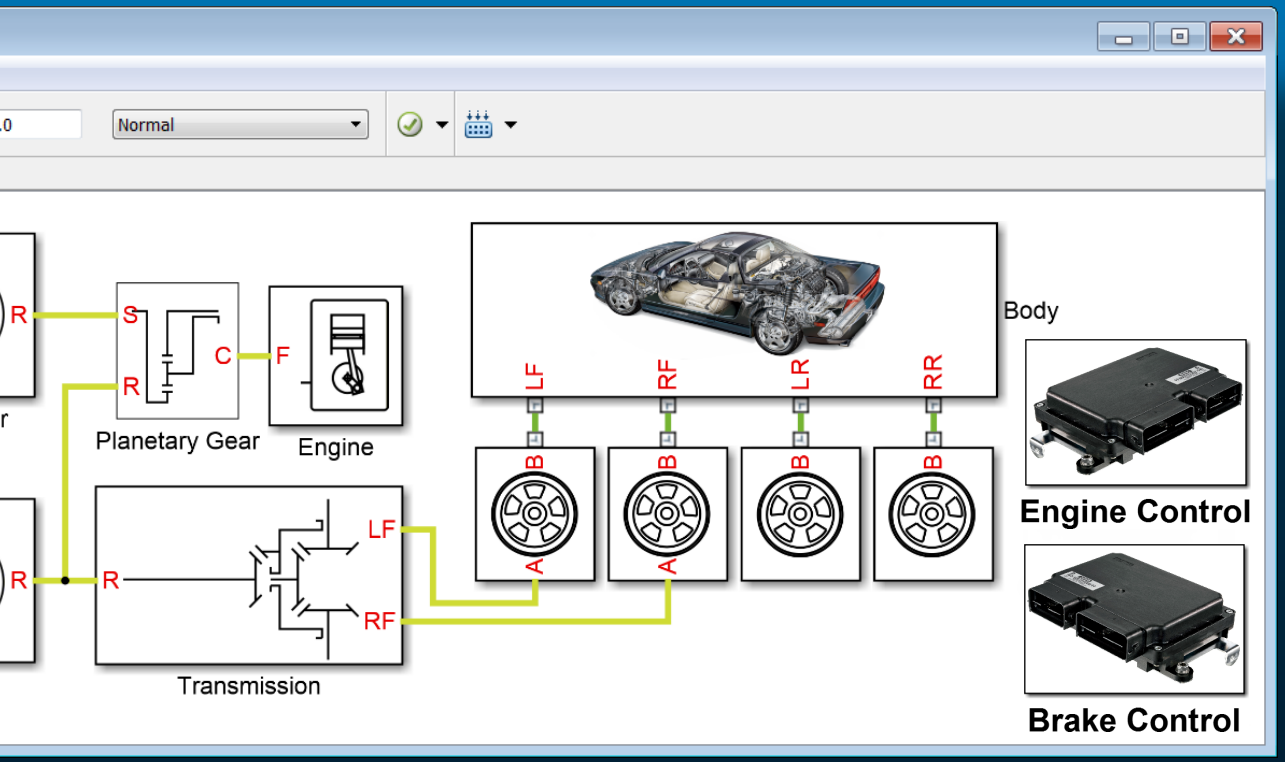
Mechanics Explorer-Vehicle_Dynamics_Susp_DLC5
Vehicle_Dynamics_S
Body
Rack_Housing
Steering
Susp_LF
Susp_LR
Susp_RF
Susp_RR
velacc
Wheel_LF
Wheel_LR
Wheel_RF
Wheel_RR
World
Prismatic_Rack
Revolute_SpinLF
Revolute_SpinLR
Revolute_SpinRF
Revolute_SpinRR
Spherical_Spindl
Spherical_Spindl
x6_DOF_Joint
Connection Frames
0%
2X
Time 0



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