THE ALTAIR MOTION SOLUTION

Rajiv Rampalli • Sr. VP Software Development • Feb. 13, 2019

Altair

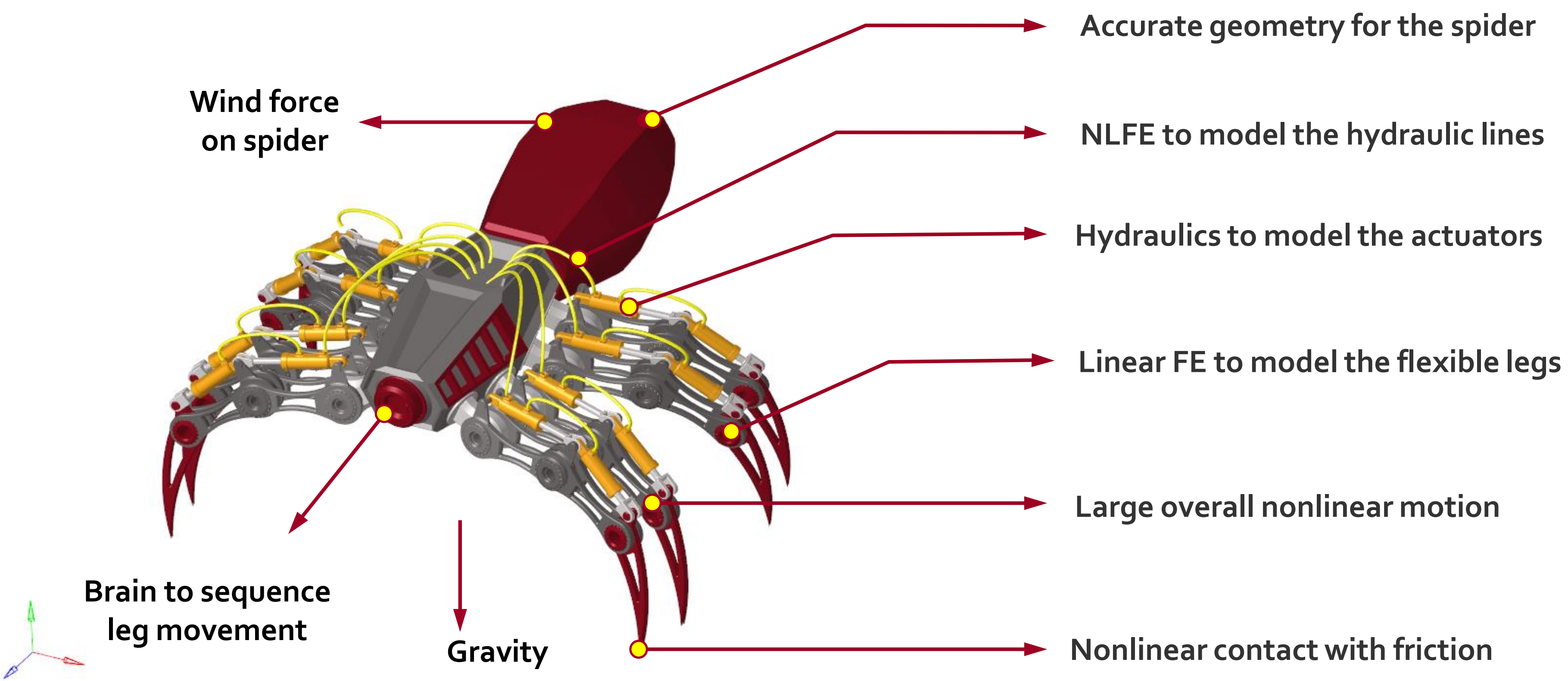
WHAT WE WILL DISCUSS TODAY…

The Current Solution → HW 2019.0 Enhancements → Future Directions

THE CURRENT SOLUTION


1: MS Model
Transient : Time = 0.000000 : Frame 1
Y
X
Z

SYSTEM SIMULATION OF A SPIDER



THE ALTAIR MOTION SOLUTION

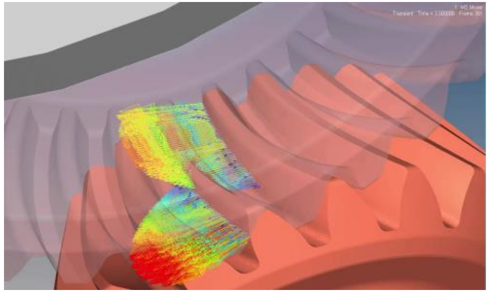
1: ASSEMBLE

Model Building

2: SOLVE

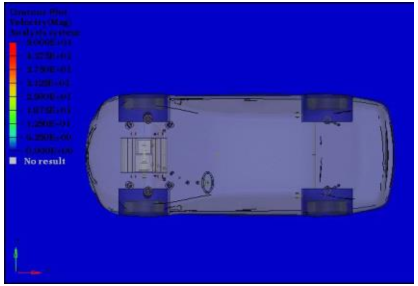
Numerical Solution

3: EVALUATE



Post-Processing

4: IMPROVE



Optimization & DOE

HyperWorks → MotionSolve

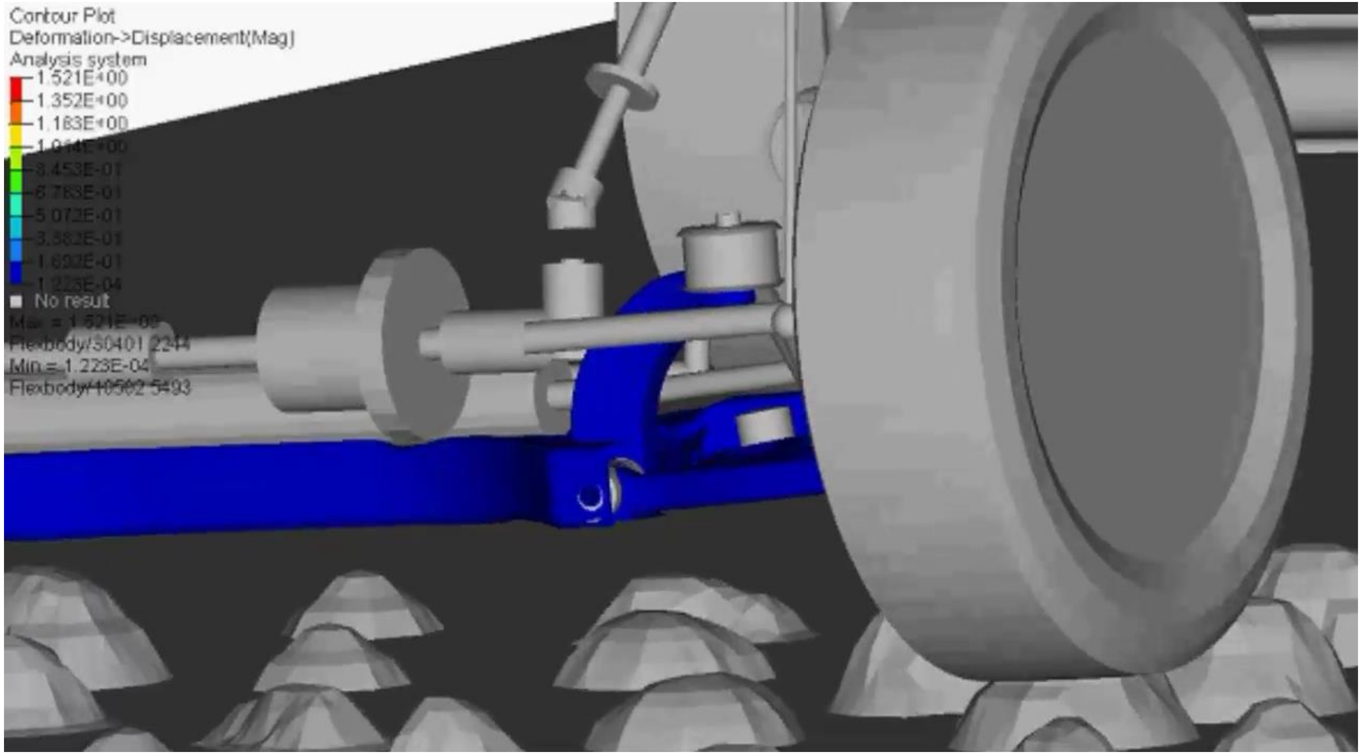
SolidThinking → Inspire Motion

#1: QUICKLY ANALYZE THE MOTION OF CAD ASSEMBLIES

Kinematics:

- Study relative motion between parts
- Compute forces required to achieve a required motion
- Determine design to achieve the required motion

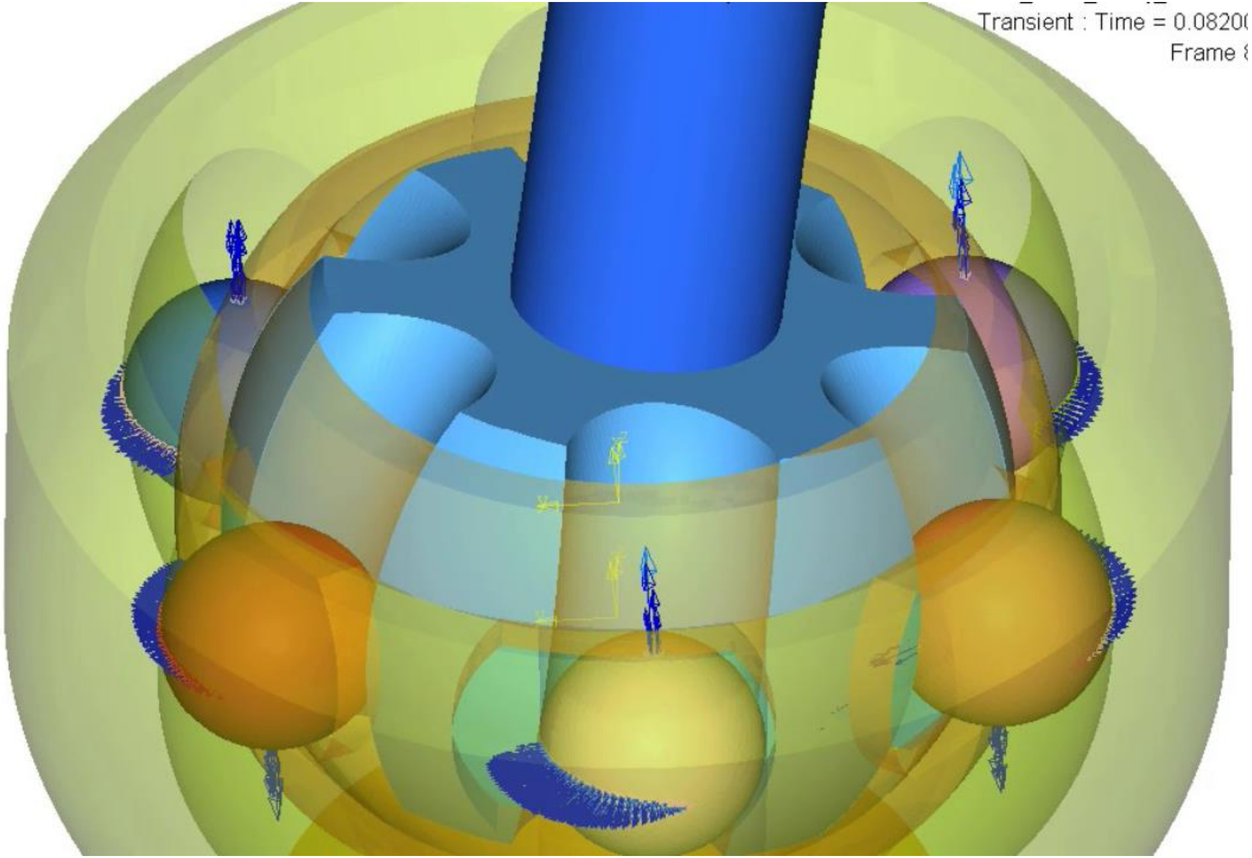
#2: CHARACTERIZE SYSTEM BEHAVIOR DURING NORMAL OPERATION



Dynamics:

- Determine nonlinear dynamic response of system
- Include flexible bodies in your model
- Compute stress, strain & deformation
- Perform subsequent fatigue analysis

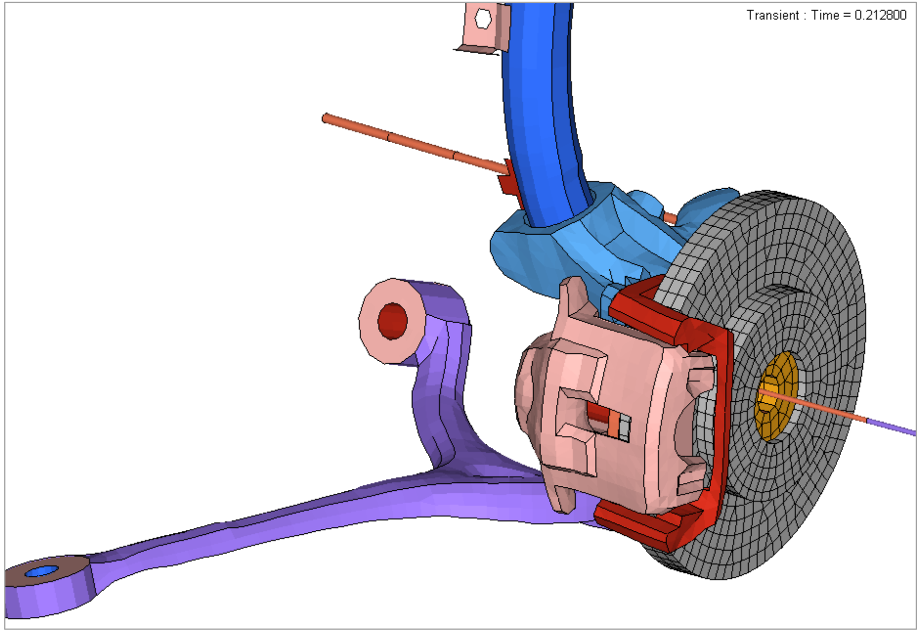
#3: UNDERSTAND & IMPROVE CONTACT DOMINATED SYSTEMS

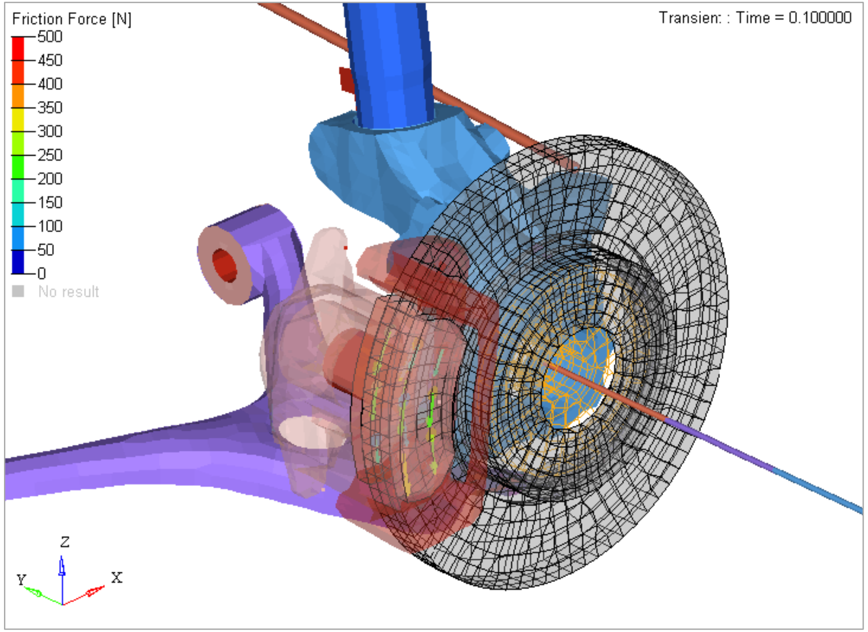


Contact:

- Use the CAD geometry you have
- Specify normal and friction force properties
- Simulate to get accurate behavior
- Examine detailed response to understand behavior

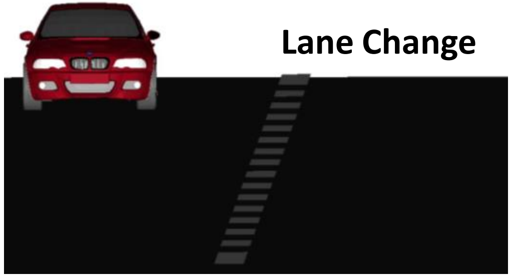
#4: MINIMIZE THE EFFECTS OF VIBRATION





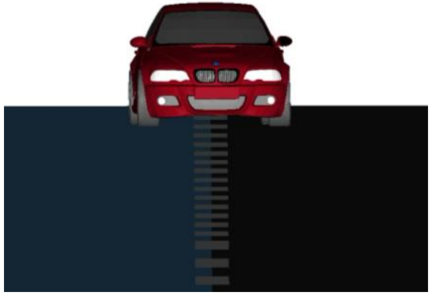
Vibration: **Predict & improve system level vibration**

#5: CERTIFY DESIGNS

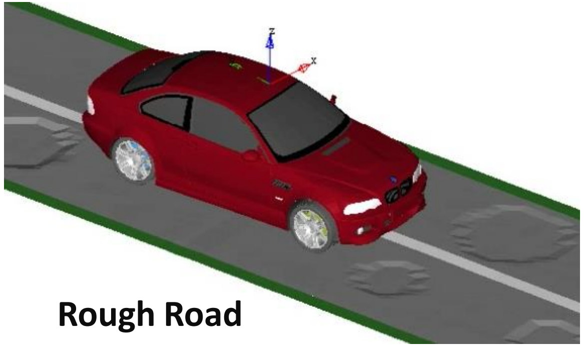


Lane Change

Slalom



Split Mu



Rough Road

Virtual Validation:

- Advanced driver to simulate complex events
- Tire-terrain interaction to simulate realistic conditions
- Integrated DOE engine for design exploration
- Standardized reports

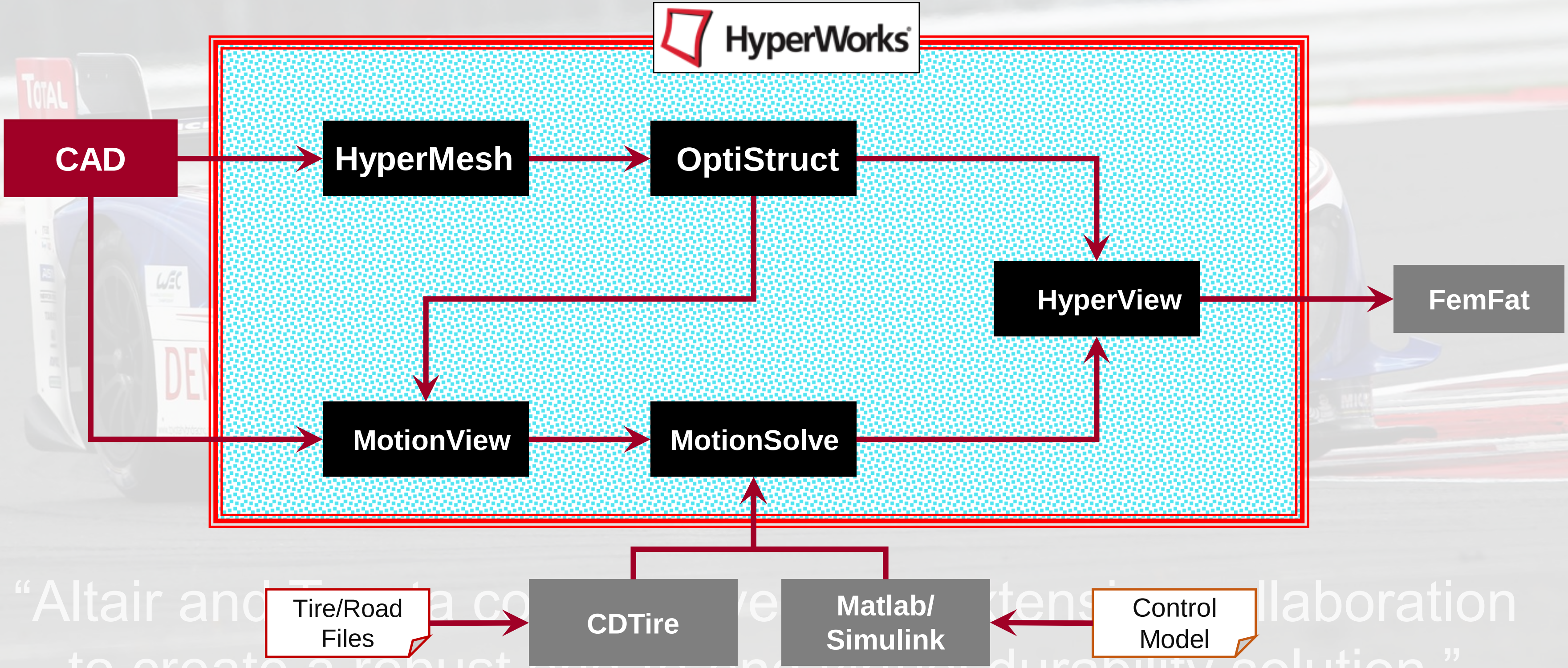
Certification: **Does the design function as intended for all scenarios?**

#6: SIMULATE AND IMPROVE COMPLEX SYSTEMS

System Model:

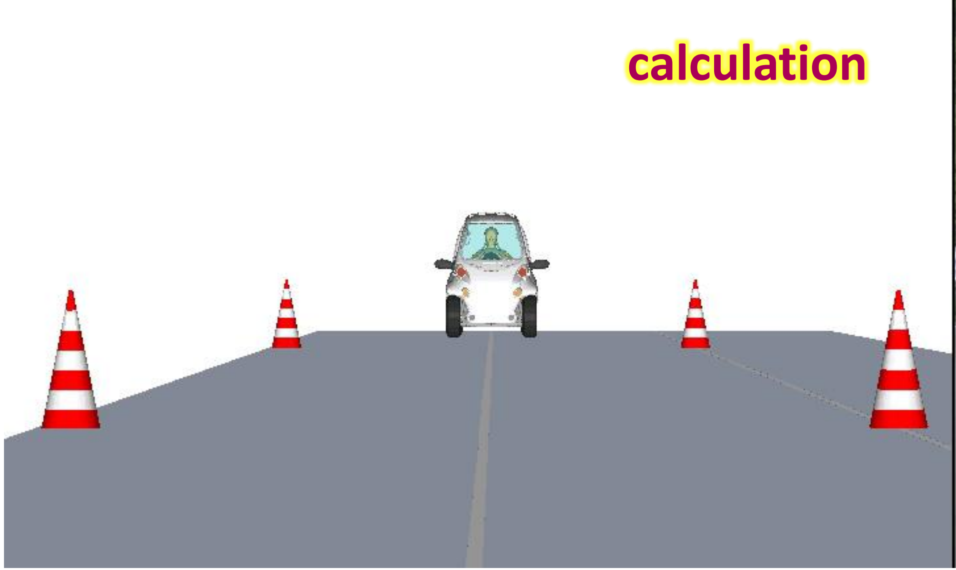
- Multibody model
- Actuation model
- Motor model
- Control model

MotionSolve in Toyota, Japan



"Smooth Driving To The Town"

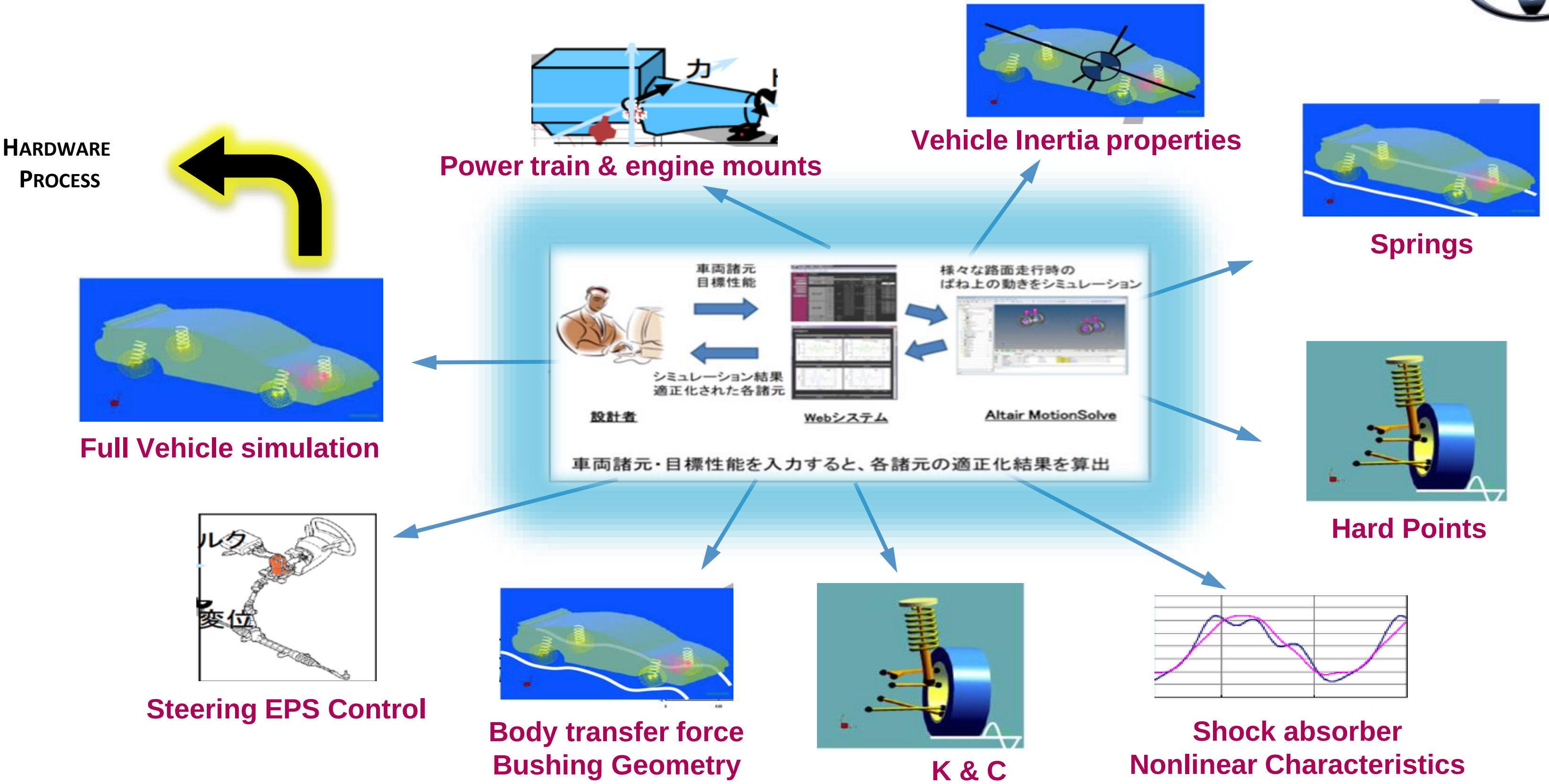
車速30Km一定　ダブルレーンチェンジ



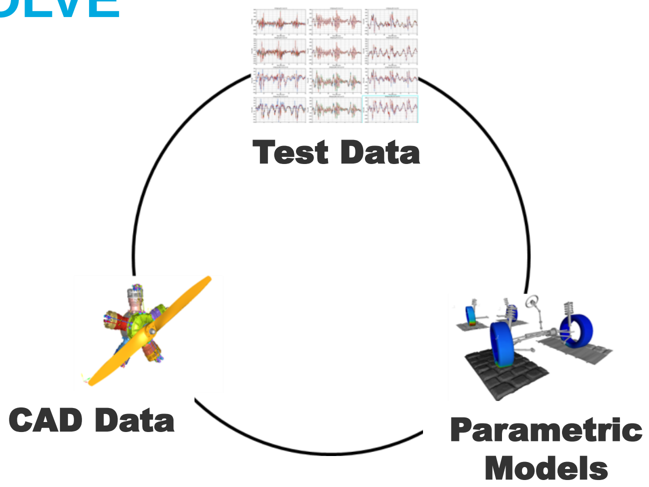
TOYOTA AUTO BODY – ELECTRIC CAR DEVELOPMENT

Accurate component loads for fatigue analysis

TOYOTA GROUP: PLANNING TEAM

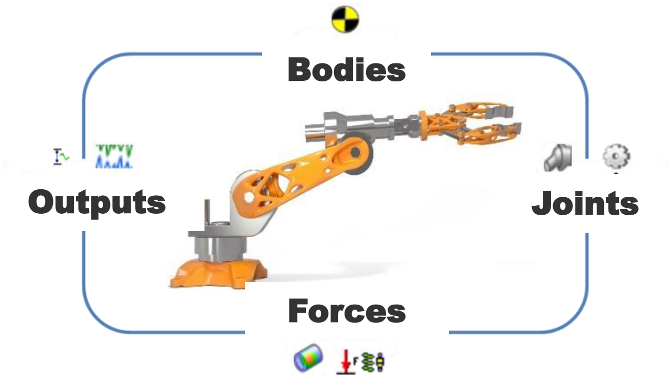


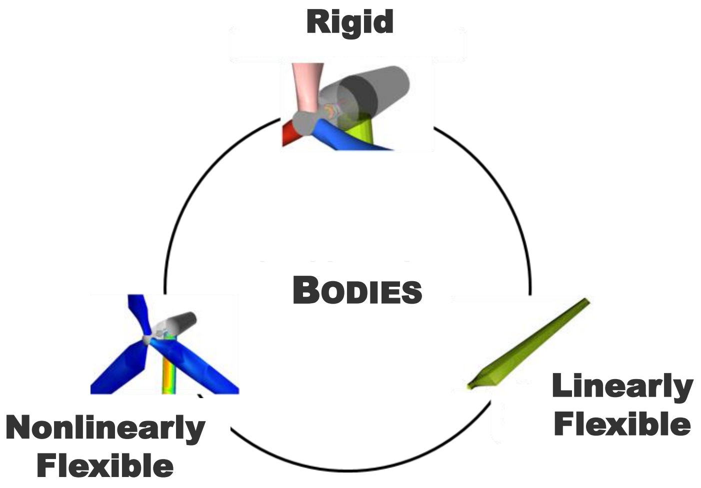
MOTIONSOLVE



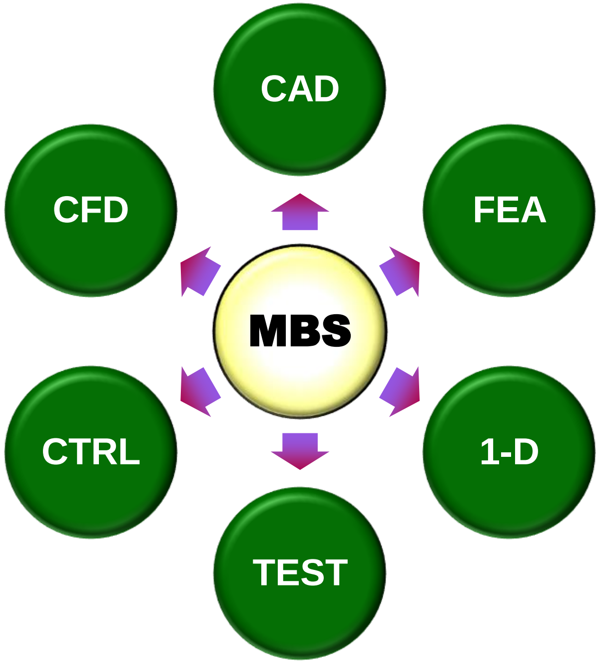
1. Assemble 2. Solve

3. Evaluate 4. Improve





MOTIONSOLVE



1. Assemble 2. Solve

3. Evaluate 4. Improve

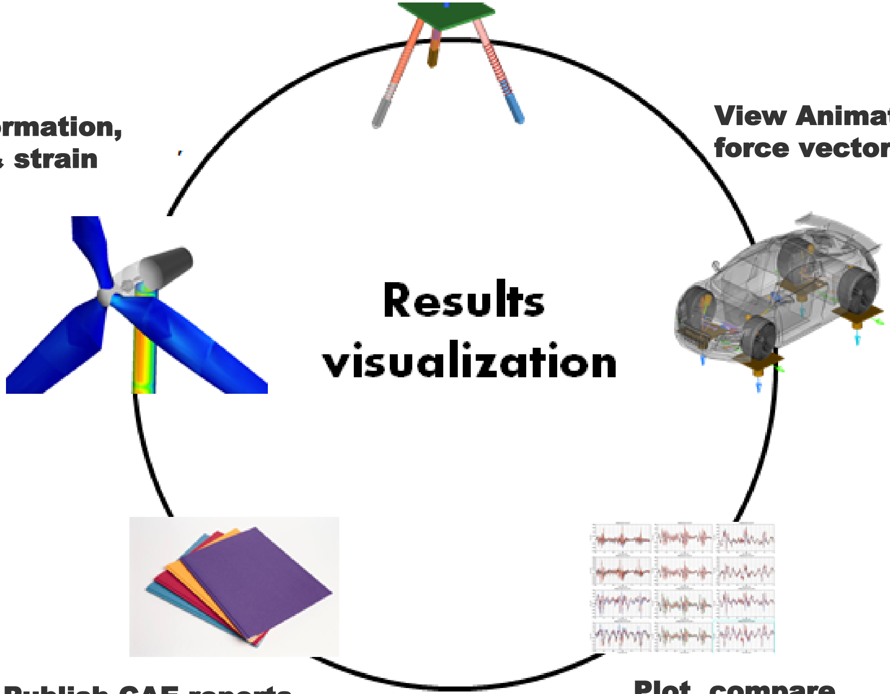
- 2^{nd} Order Differential-Algebraic Equations
- Sophisticated DAE solvers
- State of the art linear solvers
- Thoroughly validated with real models
- Fast, robust and accurate

MOTIONSOLVE

Track & trace component motion

View deformation, stress & strain

View Animations with force vectors



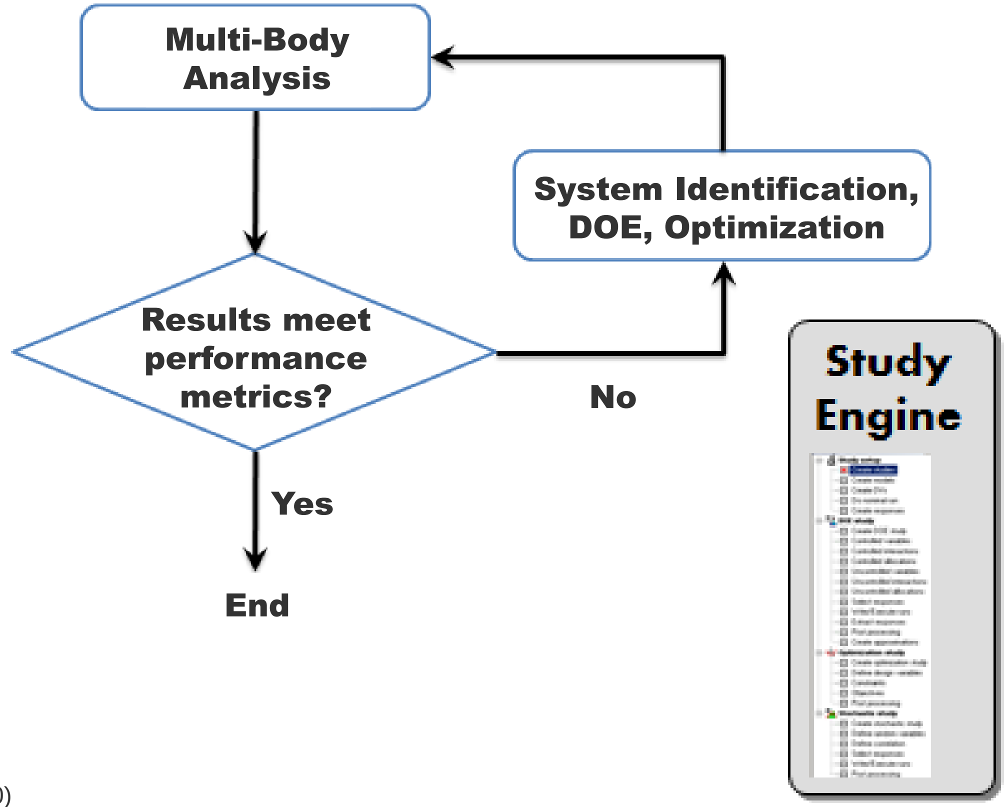
Publish CAE reports

Plot, compare, correlate

1. Assemble 2. Solve

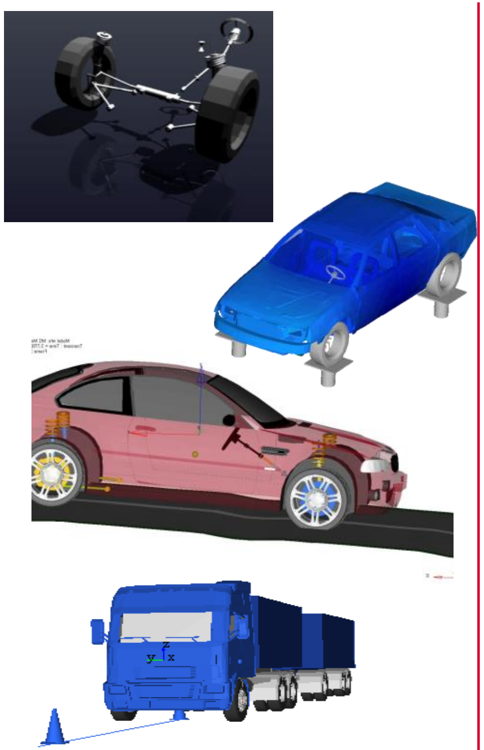
3. Evaluate 4. Improve

MOTIONSOLVE

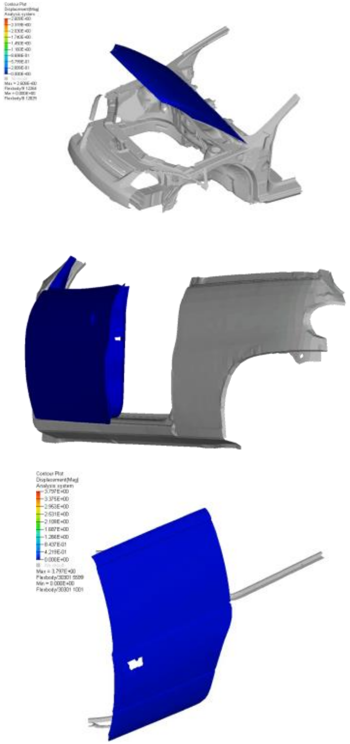


1. Assemble
2. Solve
3. Evaluate
4. Improve

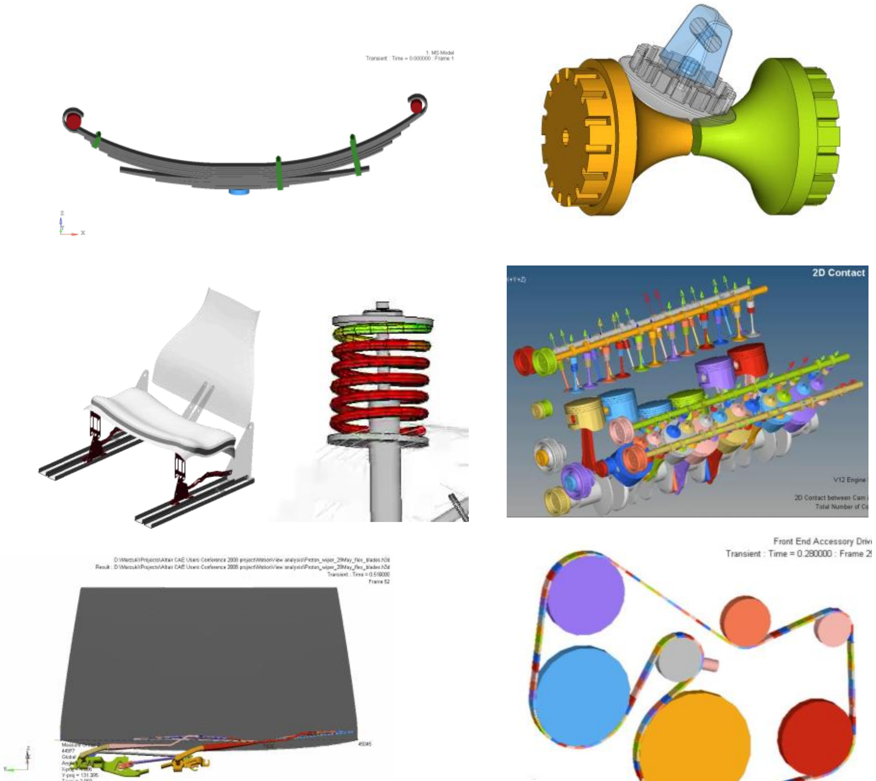
MOTIONSOLVE FOR AUTOMOTIVE



Chassis



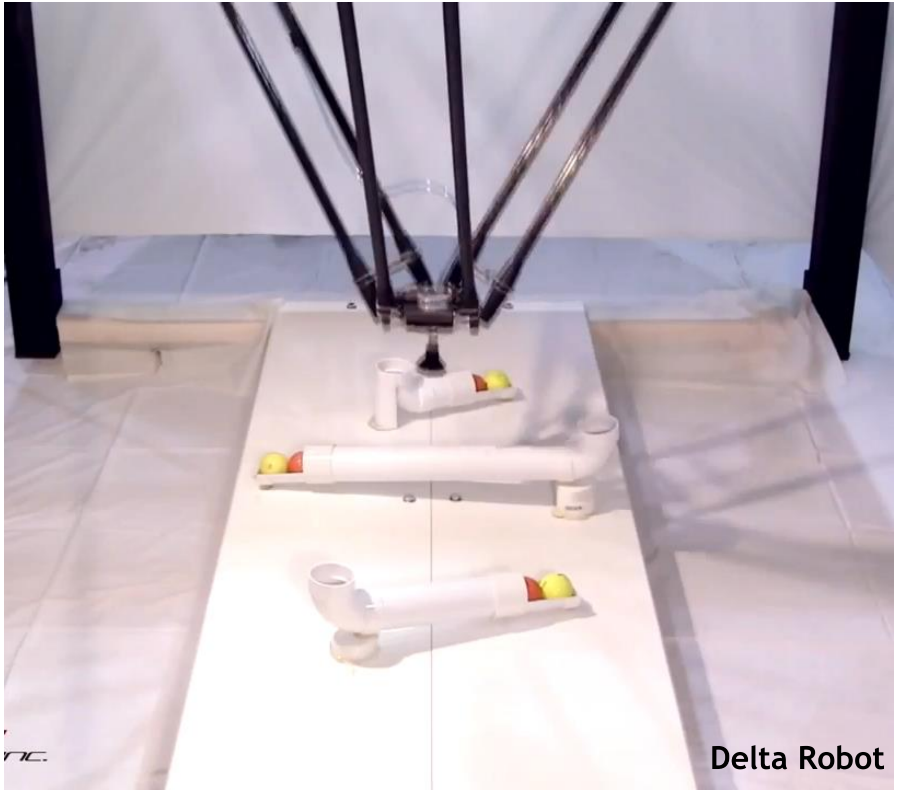
Body

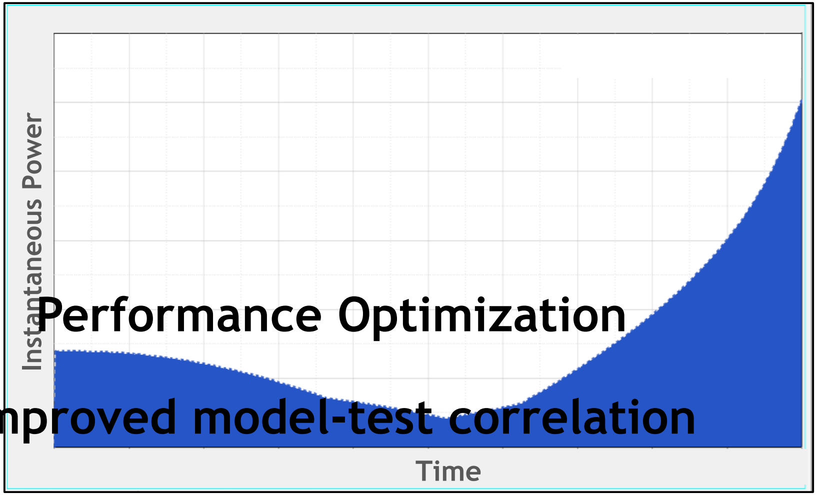


Components

KEY HW 2019.0 ENHANCEMENTS

ANALYTICAL DESIGN SENSITIVITY & OPTIMIZATION





Performance Optimization

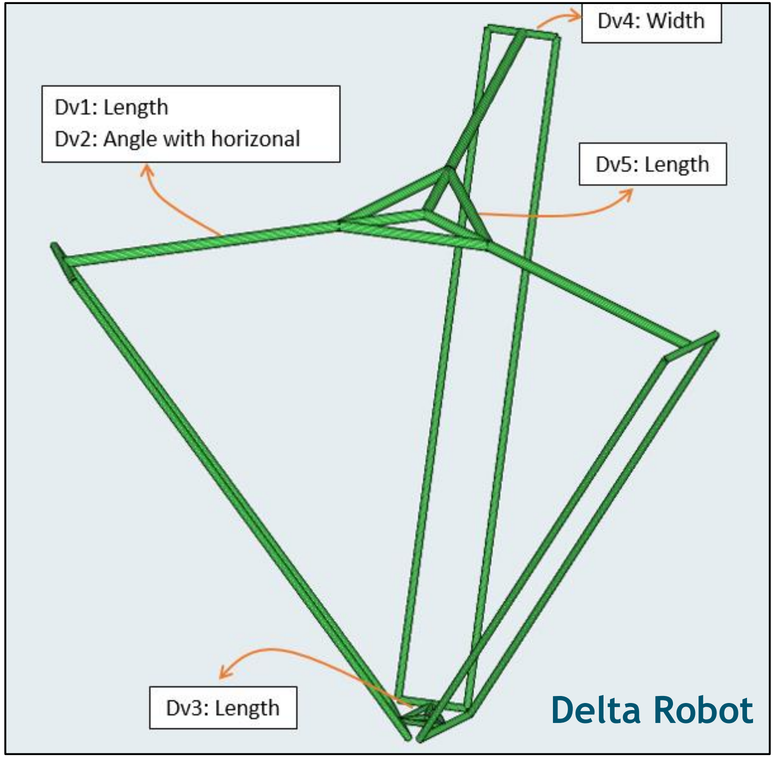
Improved model-test correlation

Optimal Control

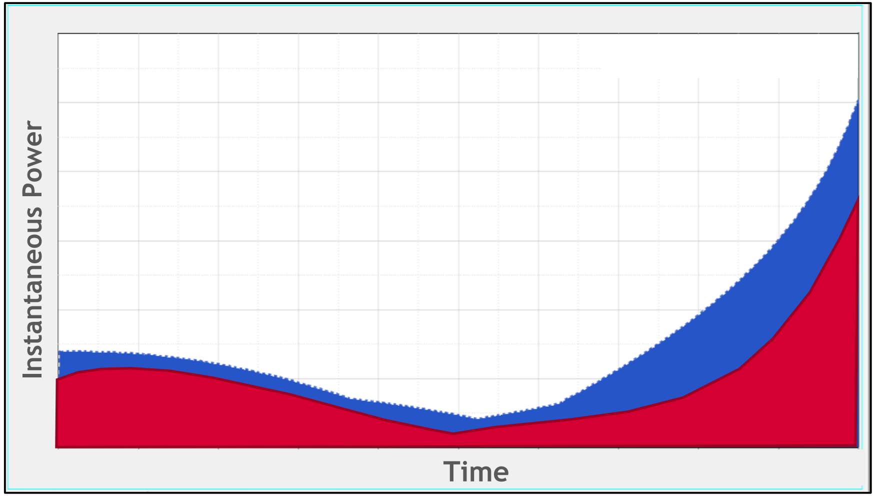
Given a work cycle, what is the design that minimizes the energy used by the Delta robot?

For a specific design & work-cycle, find the motor torques that minimize the total required energy

ANALYTICAL DESIGN SENSITIVITY & OPTIMIZATION

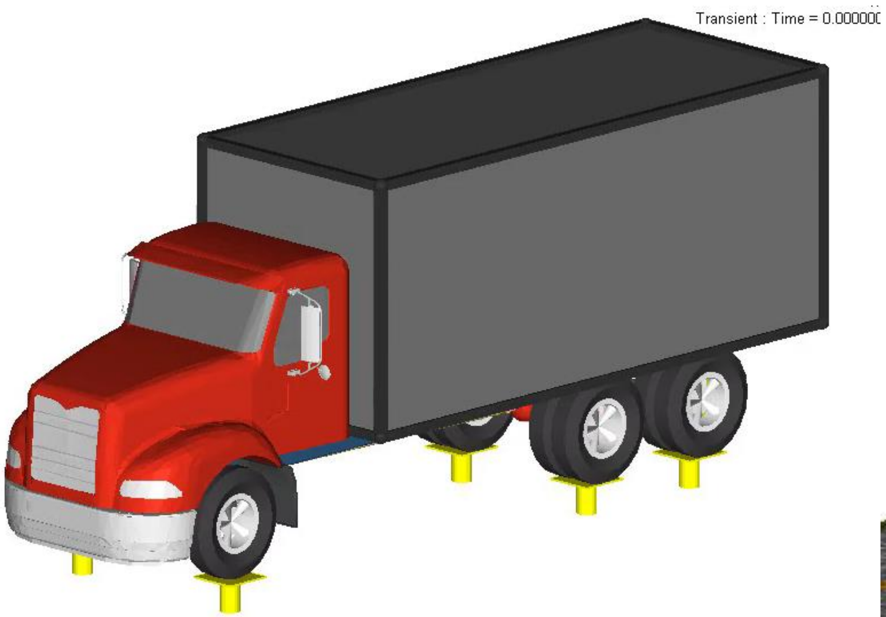


Given a work cycle, what is the design that minimizes the energy used by the Delta robot?



Energy/cycle reduction = 30%
Total CPU Time = 60s

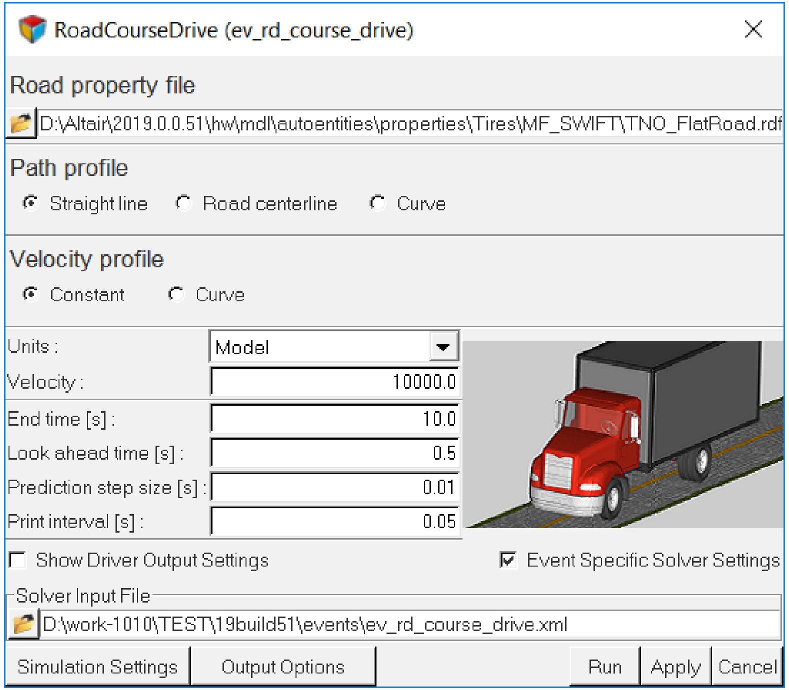
DURABILITY SIMULATIONS

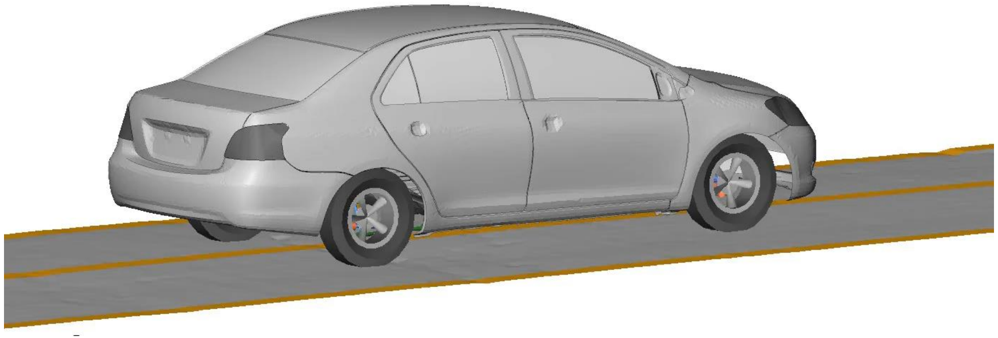


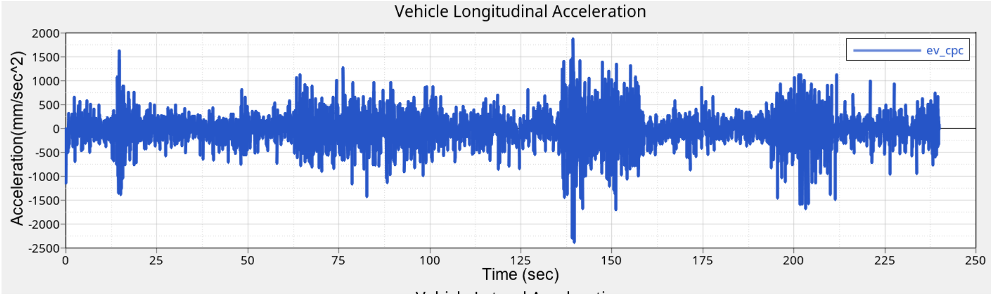
N-Post test rig

Durability Tire

ROAD COURSE DRIVE EVENT

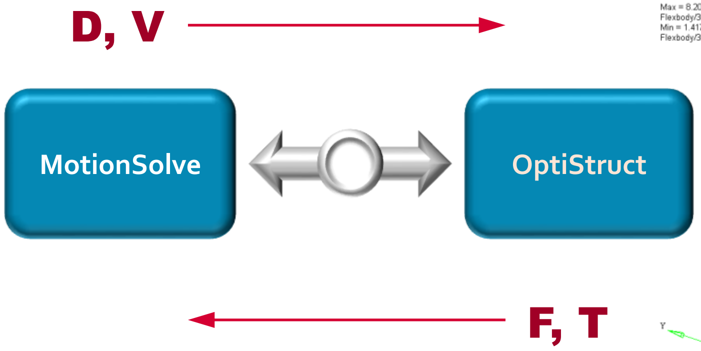


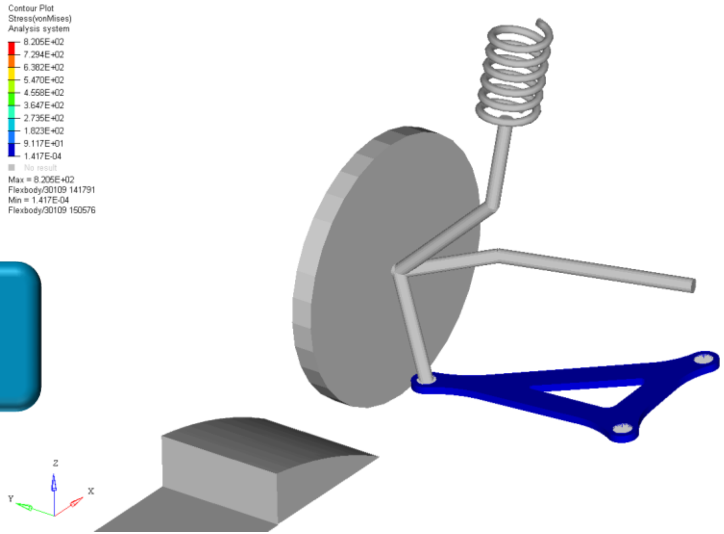




WHAT’S IN DEVELOPMENT NOW

NONLINEAR FINITE ELEMENTS VIA COSIMULATION

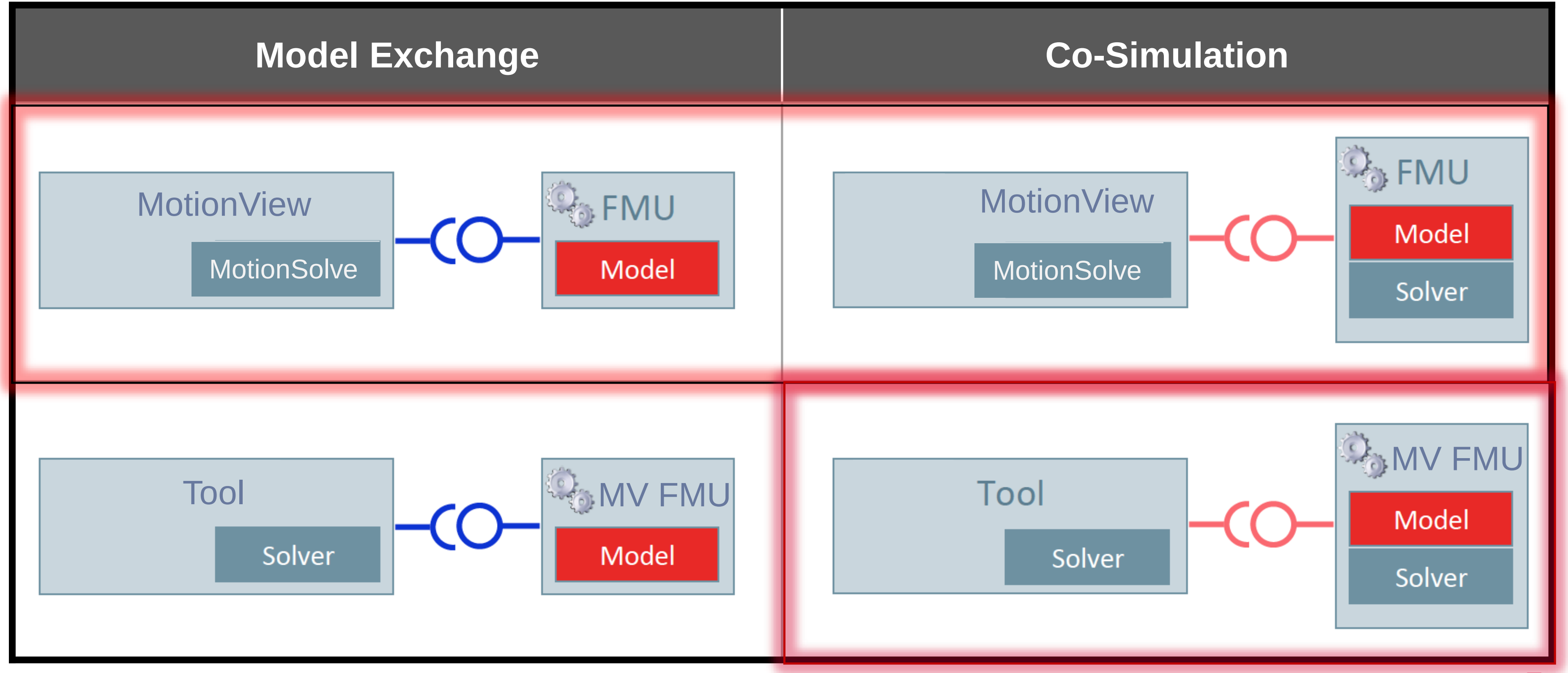




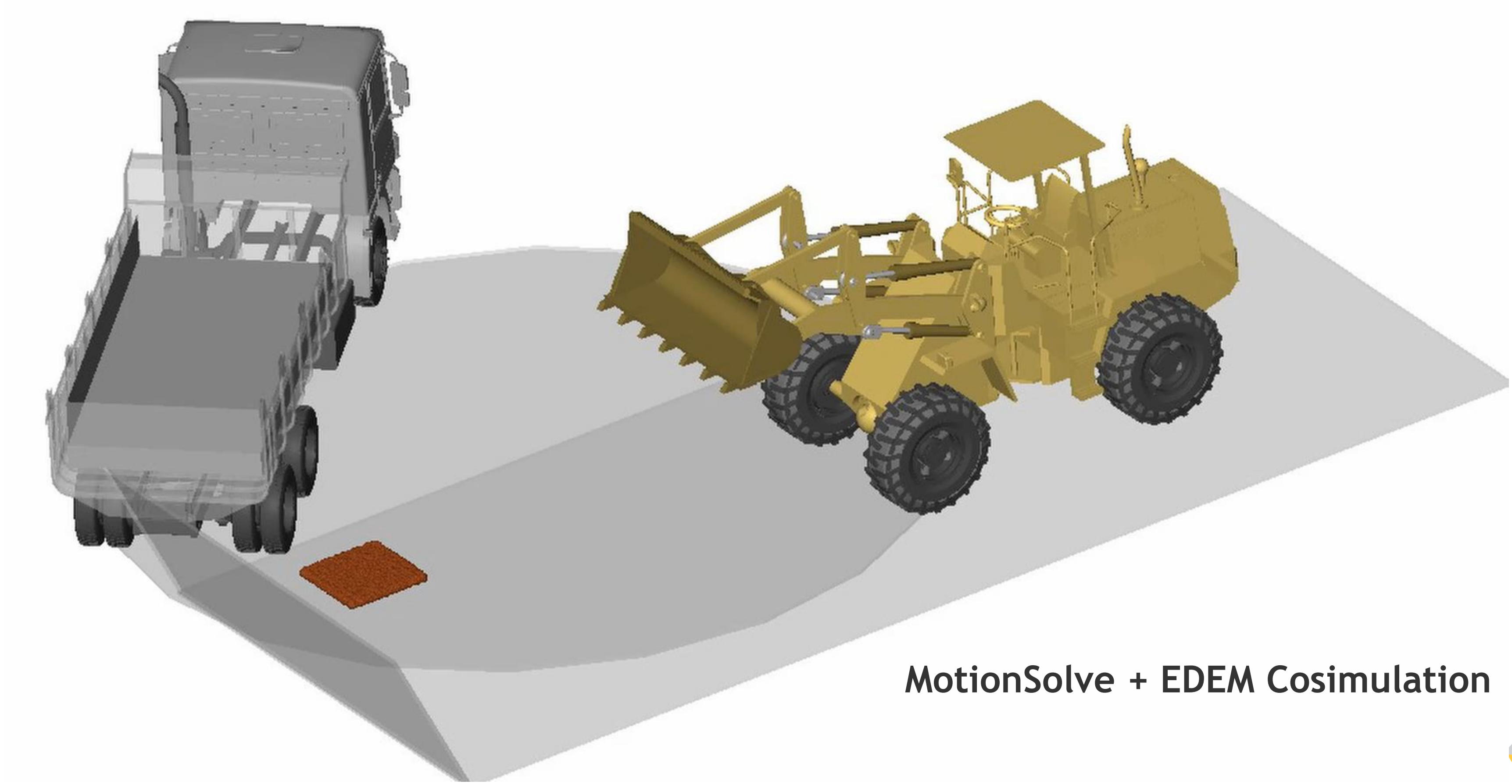
Why:

- Reuse FE models
- Plastic deformation
- Nonlinear materials
- Flex body contact

FMU SUPPORT


Model Exchange
Co-Simulation
MotionView
MotionSolve
FMU
Model
MotionView
MotionSolve
FMU
Model
Solver
Tool
Solver
MV FMU
Model
Tool
Solver
MV FMU
Model
Solver

DEM SIMULATIONS



MotionSolve + EDEM Cosimulation

CONCLUSION – THE ALTAIR MOTION SOLUTION…

01

A complete solution for analysts & designers

02

Solve realistic, multi-domain problems

03

Exciting new capabilities in 2019.0

04

Aggressive development of new capabilities