The LMS Imagine.Lab Vehicle System Dynamics solutions offer dedicated capabilities to design individual chassis system components (brakes, suspension, steering, anti-roll system, and the vehicle itself) and to integrate them in a single system model to simulate and validate global chassis control strategies. Engineers can easily connect all chassis components to each other for efficient coupling and analysis.

The Vehicle Dynamics solutions offer a unique platform to model and simulate the actuators and the vehicle with different levels of model details and easy integration with software-in-the-loop or hardware-in-the-loop validation processes. The Vehicle Dynamics solutions also include an extensive vehicle dynamics library, and interfaces with simulation suites like LMS Virtual.Lab Motion, MSC.Adams, and Simulink.

<table>
<thead>
<tr>
<th>Solution</th>
<th>Description</th>
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<tbody>
<tr>
<td>Vehicle Dynamics</td>
<td>Test and optimize a vehicle’s comfort, ride and handling behavior form the early concept stage onwards</td>
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<tr>
<td>Vehicle Dynamics Control</td>
<td>Simulate a whole vehicle, the sensors, the actuators and the control system in a single comprehensive platform compatible with real time simulation purpose</td>
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<tr>
<td>Braking System</td>
<td>Design and optimize braking systems and components and get a deep understanding of the noise, vibration behavior and control of braking system</td>
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<tr>
<td>Suspension</td>
<td>Size and analyze the circuit and the components involved in suspension and anti-roll systems</td>
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<tr>
<td>Power Steering</td>
<td>Design straightforward and robust power steering systems through stability, vibration, and couplings analysis</td>
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</table>
Vehicle Dynamics
- Comprehensive dedicated library for Vehicle Dynamics able to run in real time
- Simulate mass/inertia effects and global behavior regarding the suspension
- Standardized file for management of vehicle data
- Parametric functions to modify the shape of the cinematic tables in order to optimize the vehicle behavior

Vehicle Dynamics Control
- AMESim/Simulink interface for import, export and co-simulation
- Activity Index, Eigenvalues, Modal Shapes and State Count
- Easy integration of various sub-systems (braking system, power steering, suspension, etc.) to deliver performance improvements as well as driver support and comfort
- Detailed analysis on real time models

Braking System
- State-of-the-art for hydraulic & pneumatic component design of ABS, ESP and standard braking systems
- Real time possibilities with semi-automatic model reduction
- Analysis capabilities for specific issues posed by braking systems such as noise, vibrations and architecture impacts

Suspension
- Functional models from conception to validation
- Global view of valves characteristics
- Damper models or complete circuits
- Gas and Liquid possibilities
- Simulink interface

Power Steering
- Accurate hydraulic line models
- Electronic Control Unit integration with Simulink interface
- Pump models
- Friction models
- Interface with LMS Virtual.Lab Motion and MSC.ADAMS

The Vehicle System Dynamics solutions are successfully implemented by worldwide leading manufacturers and suppliers:

PSA Peugeot Citroen: Vehicle dynamics engineering
Delphi: ABS pump simulation
IAV: Design of anti-roll system
ZF Lenksysteme: Simulation of power steering systems
Toro Rosso: Analysis of a F1 car braking system
Doosan Infracore: Steering system of a wheel loader
International Truck and Engine: Chassis applications
Continental: Modeling of a brake actuation system
Fiat: Electro-hydraulic braking

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