Simcenter Amesim for mobile hydraulics modeling

Use multilevel modeling and advanced analysis tools to improve performance and reduce costs

**Benefits**
- Provide full-vehicle modeling for multi-attribute balancing
- Deliver model scalability from component geometry representation to functional description
- Provide interfaces with MATLAB and Simulink so you can easily couple controls for MiL, SiL and HiL simulations
- Reduce the operating costs and time-to-market
- Evaluate new design in terms of fuel consumption, energy savings, performance and emissions

**Summary**
Simcenter Amesim™ software, part of the Simcenter™ portfolio, has exhaustive multiphysics modeling capabilities for mobile hydraulic systems. It helps you integrate hydraulic components in a complete system and assess subsystem interactions within the full range of operating conditions.

To investigate instabilities and noise, vibration and harshness (NVH) issues, functional models can be combined with detailed component models. Based on control strategies and specific architectures (hybrid versus standard configurations), users can improve fuel consumption and emission levels.

**What are the challenges?**
Design high-performance vehicles:
- Reduce pressure pulsations and improve NVH characteristics
- Develop correct sizing of drivers and actuators for all working conditions
- Deliver optimal energy consumption with hybridization strategies
- Improve system safety and reliability
- Early in the process address integration issues in the development cycle:
  - Manage smart control functions for sophisticated systems
  - Integrate real mechanics (1D, 2D planar and 3D) into the hydraulic actuation system

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Features
- Use frequency analysis tools to investigate modal couplings
- Use state machine to help develop complex command laws with priority logic
- Enable the use of virtual sensors
- Use postprocessing tools to visualize energy distribution within the system (dashboard)
- Use statechart to create control laws for hydraulic machines and clutches

Powerful hydraulic solutions
Hydraulic libraries allow the user to address several simulation needs, such as functional hydraulics for the study of prevailing behaviors at system level, detailed pressure loss evaluations in high-flow/low-pressure conditions and accurate component design that takes into account full dynamics.

Full compatibility between hydraulic libraries allows a gradual increase in modeling complexity when necessary.

By considering additional effects, such as heat exchanges, designing internal combustion engine (ICE) cooling, and heating, ventilation and air conditioning (HVAC) systems, you are able to facilitate the straightforward integration of dedicated components from the Simcenter Amesim Thermal library and the Simcenter Amesim Two-phase Flow library.

Energy recovery and hybridization
Simcenter Amesim allows the user to develop full-vehicle models with hybrid or fully electrical architectures. Its versatility provides a key advantage in estimating fuel consumption and energy savings introduced by recovery systems.

The impact of architecture choices on performances can be seen early in the development cycle thanks to the complete covering of complementary physical domains, such as electrics, thermal and mechanics.

Statechart environment facilitates complex scenario design
The statechart environment is a dedicated tool in Simcenter Amesim that helps you define the state machine scenario, like mission profiles, control logics and sequences of operations that take into account initial and intermediate states, transition conditions and priorities.
Dashboard for power losses and energy distribution
The dashboard is a postprocessing feature that simplifies visualizing energy distribution among vehicle components. It facilitates the understanding and optimization of the vehicle operational costs over its lifecycle.

Controls integration
- Implementation of first level of control logics thanks to standard libraries
- Full interfaces with the MATLAB® environment, Simulink® environment and NI LabVIEW
- Blackbox option for shipping standalone plant models to Simulink users
- Import of C-coded control logics
- Code export to all major real-time platforms
- Complementary features permit the user to analyze model performance (run statistics, state contributions) and its frequency content (linear analysis) to tailor it to real-time simulation constraints

Multiple working scenarios
Roading, loading, Y-cycle

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