

LMS Imagine.Lab AMESim Ground Loads and Flight Controls



LMS Imagine.Lab

Ground Loads and Flight Controls

LMS Imagine.Lab Ground Loads and Flight Controls helps designers from the aerospace industry to size and optimize various systems and components. LMS Imagine.Lab Ground Loads and Flight Controls provides answers to typical concerns such as system sizing, development of control strategies, increasing component performance, reduction of energy consumption, increasing efficiency, understanding of wear and stress due to hydraulic/mechanical couplings, test of different load case situations and working processes. For early prototyping purposes, the solution couples the various modules together in one integrated simulation environment. This enhances compatibility, reduces implementation time, reduces learning curves, eliminates programming efforts, and delivers adapted numerical convergence.





- [Ground Loads](#)
- [Flight Controls](#)

References

Messier Bugatti - A380 steering system

Airbus - A350 landing gear

Dassault Aviation - Braking system simulation - sizing of an aircraft hydraulic network

IN-LHC - Simulation for the design of a pressure valve for an aircraft braking system

LMS Imagine.Lab Ground Loads

LMS Imagine.Lab Ground Loads delivers tools to handle landing gear, braking and steering systems. The solution supports the multi-disciplinary nature of the task (hydraulics, electrics, thermal) and takes into account system structure/actuator coupling. It addresses the challenges posed by physical tests and maintenance costs reduction, sophisticated technologies and materials, and safety and certification requirements.

For the landing gear system and suspension, LMS Imagine.Lab Ground Loads provides a complete environment with multi-level modeling and simulation, multi-domain capability and integration with LMS Virtual.Lab Motion or MSC.ADAMS 3D geometry, multi-body dynamics, structural dynamics and optimization. This makes it possible to analyze earlier in the design process to diminish risks and uncover problems. With LMS Imagine.Lab Ground Loads, users can develop validated real-time prototypes from high-fidelity simulation models using the same platform and run less physical drop tests.

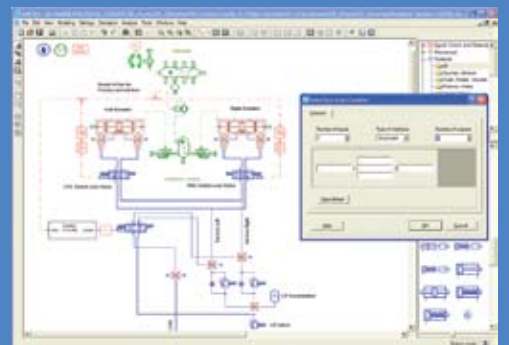
For anti-skid systems, LMS Imagine.Lab Ground Loads helps design and validate the complete braking function with a combination of electrical, mechanical, hydraulic and control equipment for the modeling of each single component, like pumps and electro-hydraulic valves. Engineers have access to a complete platform to study multiple technologies: steel, carbon or ceramic brake technology as well as hydraulic or electric actuation. It accelerates and enhances the design and validation of these systems to ensure a good compromise between performance and risk.

LMS Imagine.Lab Ground Loads also handles the design and validation of the complete steering function with a combination of electrical, mechanical, hydraulic and control equipment: design of single components like servo-controls and actuators, validation of component integration along with design and validation of control strategies.

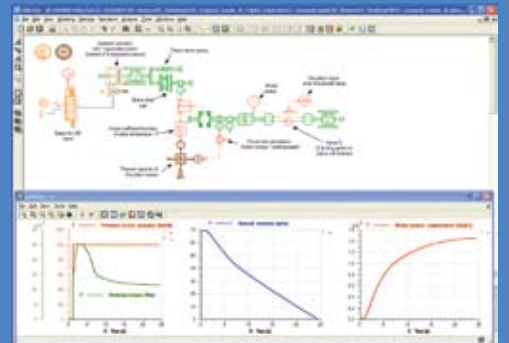
The solution significantly facilitates the exchange between aircraft manufacturers and suppliers. It becomes possible to develop validated real-time virtual prototypes from high-fidelity simulation models using the same platform. Moreover, the solution can be seamlessly coupled with subsystems and is thus able to analyze the behavior and system dynamics of the global structure and its various parts as well as test technological choices.



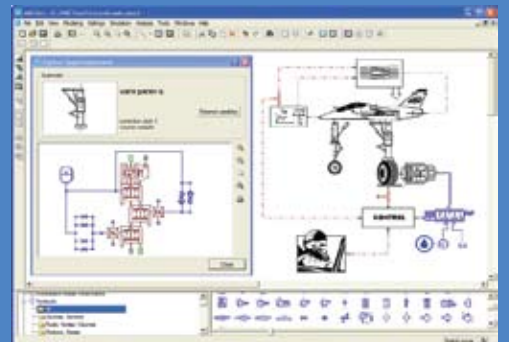
The Fluids Component Design libraries concept helps the modeling of any kind of oleo-strut in landing gears.



LMS Imagine.Lab Ground Loads analyses the coupling between the multi-domain system and the control system by co-simulation, and exports the plant model to the HIL platform for ECU validations.



Rejected take-off simulation including the modeling of the hydraulic actuator, the brake contact and heat loss calculation.



System dynamics analysis with global vision to avoid vibration of the landing gear during braking and tire burst due to skidding.

Features

- Multi-domain off-the-shelves libraries dealing with all physics issues involved in ground forces: hydraulics, electrics, thermal and controls
- Efficient coupling with 3D multi-body models/software (LMS Virtual.Lab Motion, MSC.ADAMS)
- Comprehensive set of interfaces with Mathworks products

Benefits

- Integrates seamlessly into a variety of existing development processes and tools
- Size components and systems at early stage to reduce costs and integration issues
- Develop and test the control strategies using a high fidelity plant model

LMS Imagine.Lab Flight Controls

LMS Imagine.Lab Flight Controls supports the design and optimization of flight control systems by using an unparalleled multi-domain system simulation approach. It easily handles the combinations of hydraulics, 2D mechanics and electrics in a unique modeling environment.

As flight control actuation systems become more complex, the AMESim multi-domain approach is essential to understand the interactions between diverse systems, including electrical (elevators, ailerons, roll spoilers, tail plane trim, slats and flaps, speed brakes/lift dumpers, trims), mechanical (rudder, tail plane trim) and hydraulic control systems. Moreover, the solution makes it possible to handle the development of various flight control actuation systems (mechanical, direct drive, electro-mechanical, electro-hydrostatic) by integrating it into different CAE attribute analyses like flexible multi-body and stress analysis as well as fatigue damage prediction.

The unique Component Design libraries concept (Hydraulic, Thermal Hydraulic and Pneumatic), coupled with mechanical and electro-mechanical libraries, can execute a detailed modeling in order to design high dynamic components such as nozzle flapper flow control servo valves, pressures valves and any kind of piloted fluid component.

With LMS Imagine.Lab Flight Controls, users can include different components (electrical, mechanical, and hydraulic) and perform evaluations of different functional performance attributes (multi-body, stress, durability) in a common environment. LMS Imagine.Lab Flight Controls supports the system validation process and explores the flexible bodies and mechanisms of the complete system.

Features

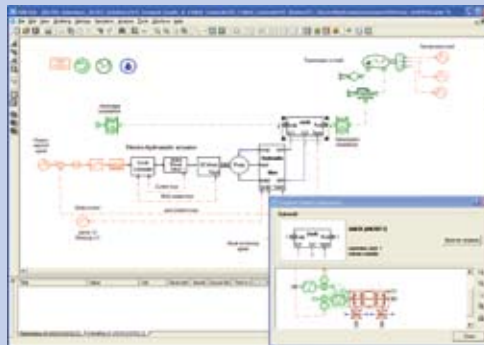
- Multi-domain, off-the-shelf libraries dealing with all physics issues involved in flight controls: thermo-hydraulics, electrics and controls
- Seamless coupling with other physical libraries (mechanical and electro-mechanical)
- Efficient coupling with 3D multi-body software (LMS Virtual.Lab Motion, MSC.ADAMS)

Benefits

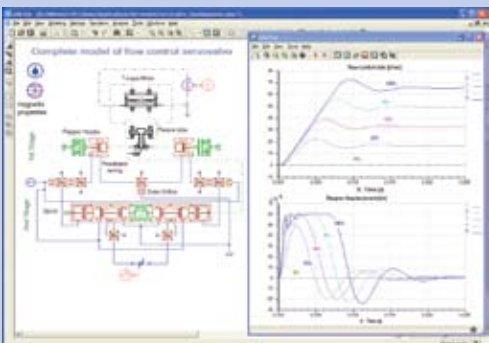
- Model the whole flight control system as well as its actuators
- Seamlessly handle multi-domain aspects (mechanical, hydraulics, electrical)
- Facilitate the development of new concepts
- Significantly reduce system development time (from months to weeks)



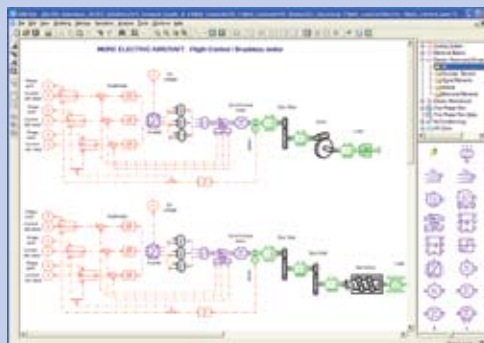
LMS Imagine.Lab Flight Controls seamlessly handles multi-domain aspects (mechanical, hydraulics, electrical).



An electro-hydraulic actuator for aircraft primary flight controls, coupling different physical domains.



Detailed model of nozzle flapper flow control servo valves to predict the component performance in function of design choices.



The flexibility of the AMESim environment helps to model electrical flight controls, detailing the mechanical effects on worm and ball screws such as friction and backlash.



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LMS is an engineering innovation partner for companies in the automotive, aerospace and other advanced manufacturing industries. With approximately 30 years of experience, LMS helps customers get better products to market faster and turn superior process efficiency into key competitive advantages.

With a unique combination of 1D and 3D simulation software, testing systems and engineering services, LMS tunes into mission critical engineering attributes, ranging from system dynamics, structural integrity and sound quality to durability, safety and power consumption. With multi-domain solutions for thermal, fluid dynamics, electrical and mechanical system behavior, LMS can address the complex engineering challenges associated with intelligent system design.

Thanks to our technology and dedicated people, LMS has become the partner of choice of more than 5,000 leading manufacturing companies worldwide. LMS is certified to ISO9001:2000 quality standards and operates through a network of subsidiaries and representatives in key locations around the world. For more information on LMS, visit www.lmsintl.com.

