Simcenter Amesim for shipbuilding

Predicting the behavior of any component or system early in the design process

Benefits
- Accurately predict the multidisci-plinary performance of intelligent systems
- Make the right choices earlier in the design process
- Connect to controls design, helping you assess and validate controls strategies
- Seamlessly integrate with your company's existing software environment
- Protect your IP and knowhow while creating and sharing your own components or libraries

Simcenter Amesim™ software from Siemens Digital Industries Software offers a complete 1D simulation plat-form to model and analyze shipbuilding systems so you can predict multidisci-plinary performance. This software provides an extensive set of specific solutions that combine strong simula-tion capabilities and effective interfaces with leading computer-aided engineer-ing (CAE) solutions and advanced tools so you can study the static/dynamic functional behavior of any component or system in a graphical, user-friendly environment.

Simcenter Amesim provides you with the unique ability to efficiently evaluate inter-actions when integrating subsystems at all the steps of the design process, from multisystem architecture to the design of systems and components, system inte-gration and control strategies validation.

With Simcenter Amesim for shipbuilding applications, suppliers are able to simulate and validate components and subsystems early in the design cycle, and provide models for their customers that need intellectual property (IP) protection. Original equipment

manufacturers (OEMs) simulate the integration of all supplier components in order to match the function specifica-tions and validate design choice.

Simcenter Amesim has been adopted as the preferred 1D system-simulation platform by major engine and systems suppliers in the shipbuilding industry worldwide.

Ship integration and multi-attribute balancing
IMO regulations surrounding emissions and fuel efficiency are forcing the whole marine industry into extensive R&D activities, aiming to develop ships which consume less fuel and produce fewer pollutant emissions. A wide variety of hybrid powertrains are under develop-ment, from power assist to fully electrical ships.

Simcenter Amesim supports the develop-ment of innovative powertrains through comparison of different propulsion system architectures for lower fuel consumption and NOx emissions. Simcenter Amesim can also be used to optimize waste heat recovery systems for diesel-electric vessel propulsion, as well as validate control algorithms for optimal power consumption and ship operation.

Simcenter Amesim comes with libraries of elements which can be used to represent the components of any hybrid or pure electric powertrain architecture:

- Combustion engines: modeling level dedicated to engine integration, including tabulated static models for fuel consumption during driving/ working cycle, and mean value mod-els for dynamic torque transient

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Features

- Innovative and open platform for mechatronic system design and simulation

- Unique combination of ready-to-use validated physical libraries for a wide range of multi-domain applications

- Efficient transient and steady-state simulations of complete industrial systems

- Built-in scalable and energy-conservative models in which the complexity level can be fine-tuned

- Powerful and simple analysis tools for the time and frequency domains
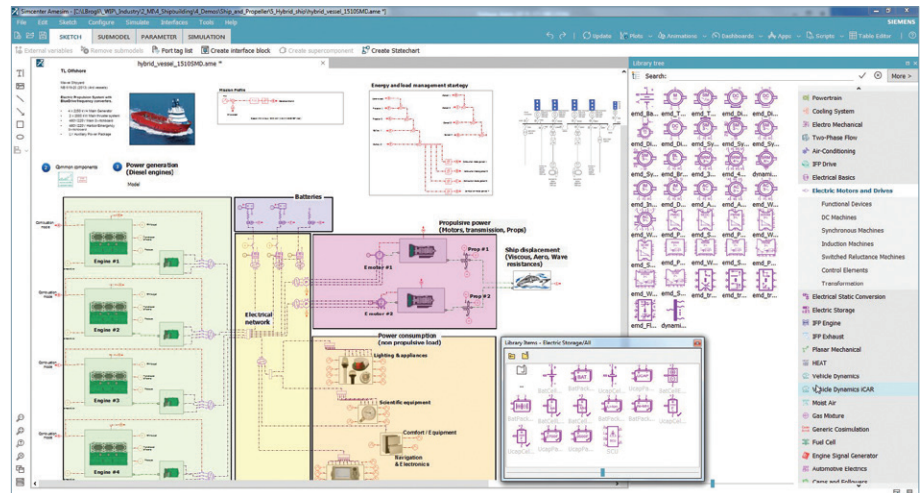
analysis, integration of waste heat recovery system and engine controls

- Marine propellers: B-SERIES WAGENINGEN propeller type (based on efficiency, trust coefficient and torque coefficient, with pitch/diameter ratio, blade area ratio, number of blades as inputs) or generic map-based model

- Ship resistance: import of CFD results, statistic model or Map-based model (experimental method ITTC78)

- Electric components: most common machine technology (DC, IM, SM, SRM,...) with dedicated control blocks, battery (Li-Ion, NiMh) pre-calibrated models or with parameter identification tool

Marine engine

Simcenter Amesim gives you the ability to study all the subsystems involved in marine engines: air path, fuel injection, valvetrain, lubrication and cooling:

- Built-in scalable and energy-conservative models in which the complexity level can be fine-tuned

- Powerful and simple analysis tools for the time and frequency domains and can adapt model definitions to a wide range of usage scenarios

Simcenter Amesim helps you model and design comprehensive internal-combustion engine systems from air management and combustion to engine control by providing accurate physical engine models and components. It offers a cutting-edge, flexible environment for designing and optimizing virtual engine concepts.

Simcenter Amesim also supports the design of fuel injection and valvetrain systems and components, from tanks to injectors. It further assists you in optimizing engine valve actuation systems for the best gas exchange process for injection systems, such as gasoline, diesel and alternative fuels such as dimethyl ether (DME), liquefied petroleum gas (LPG), liquefied natural gas (LNG), compressed natural gas (CNG)), low- and high-pressure injection systems, indirect/direct gasoline injection,
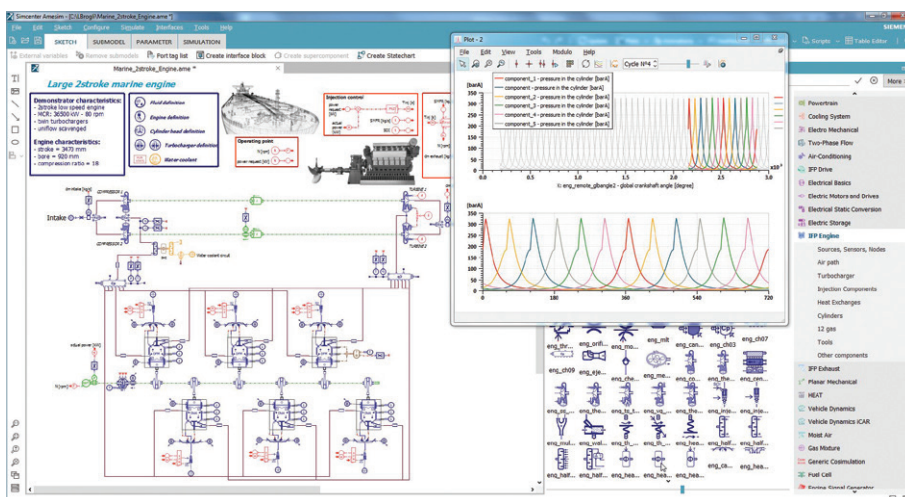
diesel common rail, unit injector and inline pump and solenoid, piezo, electrohydraulic valve or mechanical actuation.

Simcenter Amesim also supports you in the optimization of valvetrain systems through variable valve timing and cam phasers, variable valve actuation (VVA) with mechanical valvetrain (MVT), electromechanical valvetrain (EMVT) or electrohydraulic valvetrain (EHVT) systems, engine compression brake, hydraulic lash adjusters, chain tensioners and camless systems.

Further, Simcenter Amesim enables you to model engine-cooling systems, including all components (pump, thermostat, heat exchangers, etc.) with the associated heat exchanges. It comes with a set of physics-based elements, advanced component libraries and a heat exchanger stacking tool for thorough system analysis (isothermal or thermal) in steady-state and/or transient configuration. You can calculate the coolant flow rate distribution as well as predict pressure and temperature levels throughout the circuit to study individual component and global-system performances and behavior.

Simcenter Amesim also offers the required tools to model and design the entire engine-lubrication system with all the associated components (pump, valves and bearings) for performance validation, system optimization, failures investigation and evaluation of new architecture. You can perform steady-state and transient analyses, as well as isothermal or thermal analyses. The lubrication solution is able to be used to run steady-state and transient analyses, which take thermal effects into account. For example, it is possible to assess the thermal interactions between components and develop related heat-management strategies for oil-cooler and piston-cooling jets.
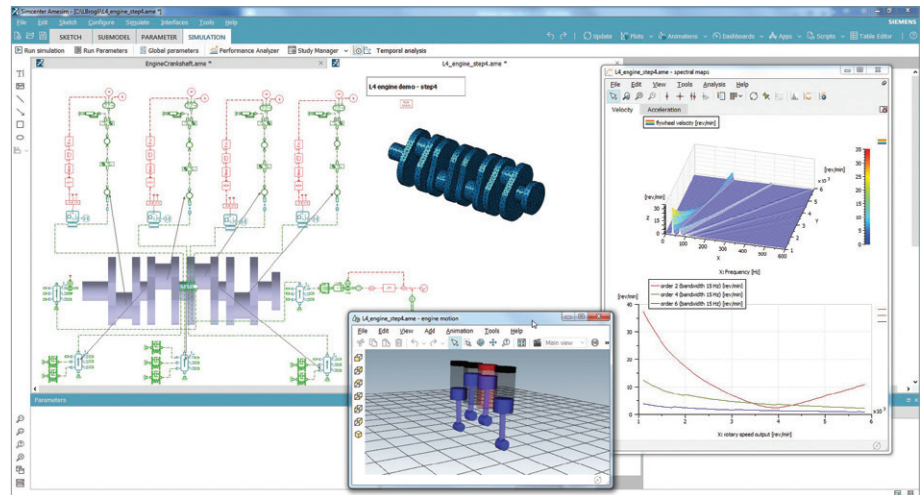
Marine-propulsion NVH
Simcenter Amesim gives you an in-depth understanding of powertrain-system noise, vibration and harshness (NVH) performance. It provides all the required information on the root causes of noise and vibration problems related to mechanical contacts. These problems can potentially generate a negative quality perception or key component durability problems.

You can focus on NVH sources and related corrective component efficiency, such as engine torsional harmonics and propulsion shaft vibration analysis. The solution provides a better physical understanding of

driveline vibrations due to a combination of linear and nonlinear systems (dry frictions, variable stiffness, endstops, bearings, joints and gear backlash).

Electrical systems
Simcenter Amesim provides a set of component models, including electric motors, power electronics and storage devices to simulate electromechanical components and electrical systems.

You can represent electric storage systems with variable-model complexity, using powerful features in order to accurately evaluate energy exchanges of batteries or similar electric storage devices in variable environment
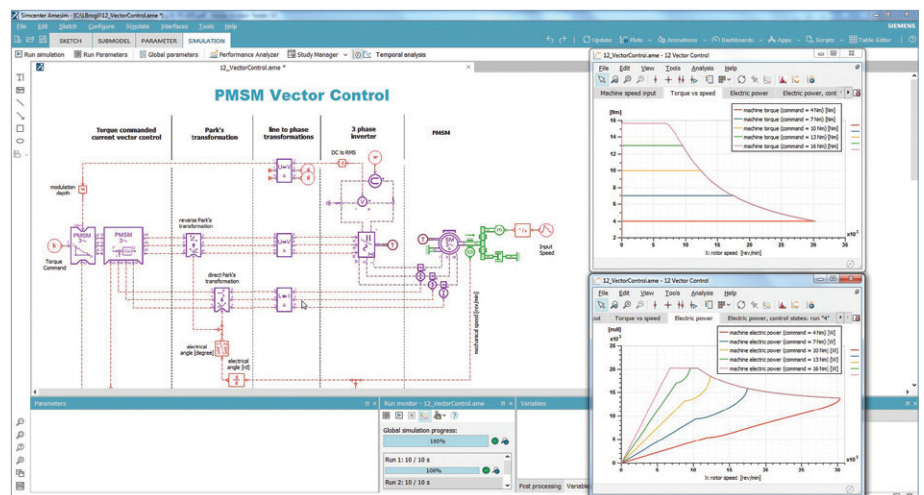
conditions, and specify power and energy needs in multidomain systems. Simcenter Amesim also gives you the ability to size a pack, design a corresponding cooling subsystem or validate the related controls strategies.

In addition, Simcenter Amesim helps you analyze electromechanical components and electrical systems in a multidomain environment while you're evaluating the performance of new architecture (sizing of generators, power converters, storage elements, applied loads, etc.), analyzing energy consumption and designing and validating control laws. You will also be able to optimize dynamic performance, check controls, minimize energy consumption, study the impact on the electrical environment (voltage drops and current peaks) and design power networks with different model complexity levels: quasi-static models for the power- network sizing, slow-transient models for loads to evaluate the influence of first-order dynamics on the network, and more complex models for the alternator and battery. Moreover, you can validate control laws for optimization of the electric power management and estimate transient behavior of each component and the impact on the whole network.

You can size fuel-cell systems and components, as well as design, analyze, validate and optimize system architectures, operating conditions, choice of materials and control strategies, while also defining and specifying the optimal system architecture, taking into account thermodynamics, electrochemistry, multiphase flows, thermal behavior, mechanics, electrical management and control.
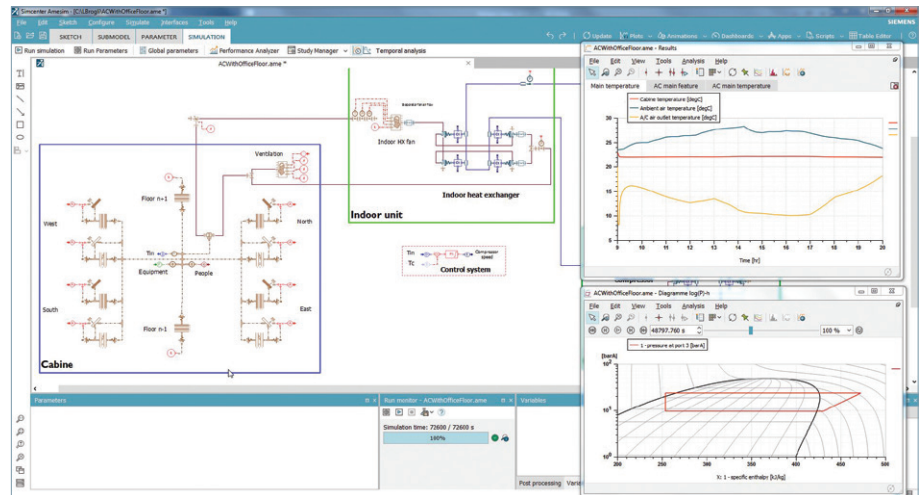
Hydraulic systems
Simcenter Amesim enables the design of fluid power actuation systems and components for deck crane hydraulic systems, controllable pitch propellers, steering gear, etc. The solution provides you with a set of cutting-edge features and advanced-simulation tools for developing products with components actuated by hydraulic and pneumatic fluid-power systems, improving product quality with robustness and reliability, reducing power generation (variable displacement pumps, load-sensing) and developing and optimizing new functions (self-leveling, control strategies).
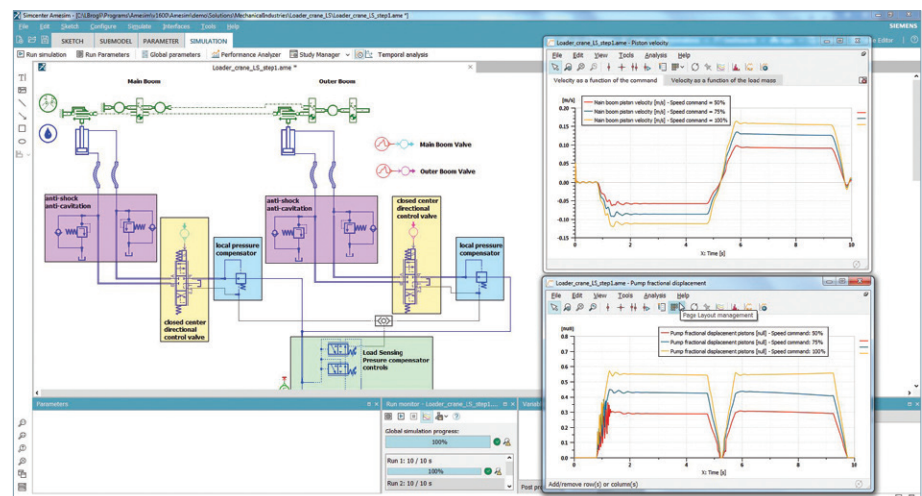
Environmental control systems

Simcenter Amesim helps you design the optimal environmental control system that makes air breathable and comfortable in terms of pressure, temperature, flow and humidity. It enables you to handle multidisciplinary systems for advanced design of: gas dynamics, thermal pneumatics, vapor cycle (two-phase flow), air conditioning, controls and life and environmental sciences.

It helps you design systems involved in environmental control systems, including: bleed system control, global energy management, air conditioning, ventilation circuit, oxygen circuit and the cabin. The solution easily handles high-system complexity and takes into account multiple parameters (temperature, humidity, pressure and change of pressure rate) in dynamic conditions.

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