LMS Samtech

SAMCEF
Wind Turbines

Software Platform for
Wind Turbines Simulation

XLMS ®

A Siemens Business

With the increase of their size and the growing tendency to place them offshore, wind turbines have been the subject of an intense race for innovation. Simulation tools are massively following this trend. SAMCEF Wind Turbines is in that frame bringing innovations to the various fields of wind turbines design.

SAMCEF Wind Turbines (SAMCEF Wind Turbines) can be used at different stages in the wind turbine engineering process and by different engineering teams (loads departments, transmission groups, component teams, integration programs...). A combination of dedicated graphical user interfaces and the high performance solver SAMCEF Mecano, makes SAMCEF Wind Turbines perfectly suited to simulate flexible dynamics phenomena with high accuracy.

Forty years of experience in modeling large flexible machines and ten years expertise in Wind Energy have been incorporated into a platform fully dedicated to Wind Turbine simulation: SAMCEF Wind Turbines.

BENEFITS

- Easy and fast to build your WT model thanks to pre-embedded parameterized models

- One single platform for loads computation with two different goals:

  - High computation speed models and embedded certification load cases and scenarios

  - High accuracy models closely representing the physics of your machine for detailed design purposes

- Global analyses of complete machines or local analyses of single components available in the same environment

- Scalable model definition

- Full offshore capacity. Easy to model Fixed structure as well as a floating structure

- Composite material available to analyze accurately blades behavior in the wind turbine context

- Ease in modeling and testing new concepts thanks to software openness

- Increased collaboration between different teams due to easy integration of new components into global models

- Reuse of existing data through interfaces with Bladed and Flex 5

- One unique solver that compute the solution in the time domain by direct integration (mixing flexible bodies with composites, Multi-Body dynamics, control system, aerodynamic and hydrodynamic forces...). Dedicated post-processing tools meeting the standards of industry

- Reduction of design cycle resulting from reduced needs for physical testings

- Reduction of costs due to faster design and improved reliability

- One simple but powerful user-oriented software to develop your expertise and take advantage of your industrial know-how at simulation level
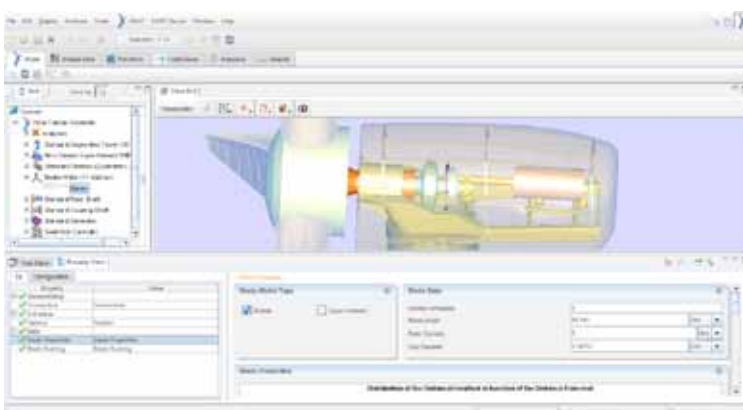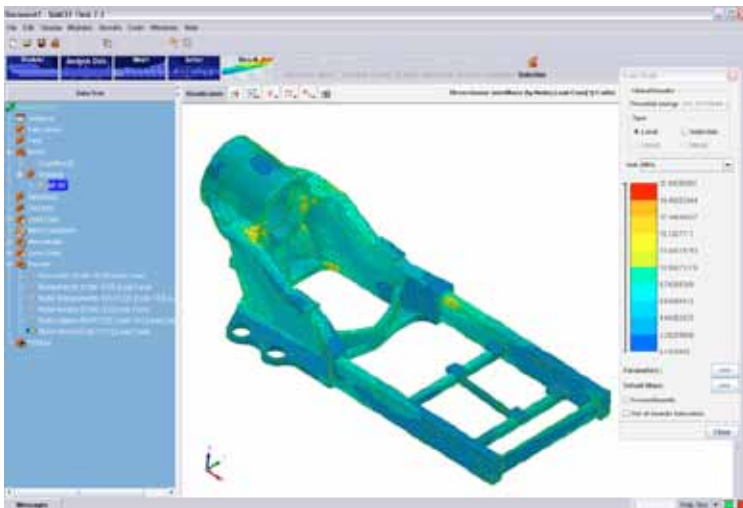
3 APPLICATIONS, 2 INTERFACES, 1 PRODUCT

SAMCEF Wind Turbines can be used in different contexts depending on the targeted application:

- Load assessment:
    - using simple models for fast computations;
    - using more detailed models for higher accuracy. The latter is used on the ultimate load cases which are determined using simple models;
- Mechanical components design (yaw, gearbox...) based on the Multi-Body Simulation features of SAMCEF Wind Turbines;
- Structural components design (bedplate...) based on the Finite Elements features of SAMCEF Wind Turbines.

SAMCEF Wind Turbines comes with two Graphical User Interfaces: one dedicated to computation of loads on global models and one to local modeling of components;

- SAMCEF Wind Turbines Desktop includes pre-embedded parameterized, global configurations that have been industrially validated for a range of turbines. Different models with varying levels of complexity exist for most components as well as pre-embedded certification load cases.

    Being an open platform, new concepts for any number of components can be easily integrated (gearless and offshore turbines are therefore easily modeled);
- SAMCEF Wind Turbines Modeler is a generic FEA pre-processor. As such, it can be used to build your own models of single components. These models can then be prepared to be automatically assembled with existing global models inside SAMCEF Wind Turbines Desktop. This interface can also be used to run local analyses on the same components based on loads computed in SAMCEF Wind Turbines Desktop;

Three possible applications, two interfaces but one single solver is running in all these cases. SAMCEF Mecano is a generic non-linear Finite Elements solver including Multi-Body Simulation features perfectly suited for dynamic analyses of large flexible structures. Local or global modal analyses can be run from SAMCEF Wind Turbines to compute resonance frequencies and corresponding mode shapes of single components as well as of complete turbines.

Dedicated post-processing tools include time plots, trajectories, spectrogram diagrams (waterfalls), extraction of ultimate loads... in addition to specific export bridges to post process your results using Flex 5 or Matlab.

Specific tools deduce fatigue, durability and extreme loads from load time histories of thousands of load cases.

KEY FEATURES

- Offshore design parameters
- Turbulent wind generator
- BEM method for aero elasticity

- Parametric PID Controller with SCADA System
- Direct use of control commands DLL files

- Gear elements taking into account teeth stiffness, backlash, conical gears, helical gears, internal gears and the easy definition of complete planetary stages
- All other transmission elements available (revolving joints, bearings...)
- Non-linear bearing models including clearances
- Non-linear beam, shell and volume elements

- Newmark and HHT time integration schemes
- Automatic time step algorithms
- Management of small (less than 100) and large numbers of Dofs (up to 100,000)
- The ability to mix FEM and MBS features in one model if requested

---

- CAD geometry creation and import
- Data assigned on geometry or mesh
- Easy use of reduced models (Super Elements) generated inside SAMCEF Wind Turbines or imported from other FEA packages
- Automatic component assembly tool to connect to your own component to an existing global model
- All standard load cases (IEC & GL) Easily created
- Different results available:
    - Time response curves of loads in key elements (bearings, shafts, gears...)
    - Animation of the complete turbine after transient or modal analysis
    - Display of the frequency content of a signal (FFT or Waterfall Diagrams)
    - Fatigue post-processing on main components
    - Campbell diagrams
    - Stress distribution on structural components

Leading partner in
Test & Mechatronic Simulation

LMS is a leading provider of test and mechatronic simulation software and engineering services in the automotive, aerospace and other advanced manufacturing industries. As a business segment within Siemens PLM Software, LMS provides a unique portfolio of products and services for manufacturing companies to manage the complexities of tomorrow's product development by incorporating model-based mechatronic simulation and advanced testing in the product development process. 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 and mechatronic simulation solutions, LMS addresses the complex engineering challenges associated with intelligent system design and model-based systems engineering. Thanks to its technology and more than 1250 dedicated people, LMS has become the partner of choice of more than 5000 manufacturing companies worldwide. LMS operates in more than 30 key locations around the world.

⊠ LMS ®

A Siemens Business