CivilFEM powered by Marc

Nonlinear Analysis for Advanced Engineering Applications & Construction Processes

Overview

CivilFEM powered by Marc is a powerful, general purpose, implicit nonlinear, finite element analysis (FEA) software with a modern object oriented program architecture. It can accurately simulate static, dynamic and coupled physics problems for a wide range of design and construction applications. Unlike other linear FEA methods that rely upon making simplifying assumptions, CivilFEM powered by Marc enables user to emulate the complex nature of real world behaviour and construction processes to ensure highest design confidence and project performance under realistic environments and operating conditions. Recognized as the world first commercial nonlinear FEA software, Marc solver has, since 1971, continually delivered innovative and robust solutions that are well-suited for analysing the structural integrity and behaviour of any type of structures experiencing geometric, material, and/or boundary nonlinearities.

Advanced Capabilities to Simulate Real-World Behaviour

Simulating the correct characteristics and behaviour of all model part is crucial in predicting the complex nature of today´s real world analysis challenges. CivilFEM powered by Marc uses the latest, proven, linear and nonlinear numerical analysis and modelling techniques to perform static, transient, buckling, post-buckling and time frequency based dynamic simulations for a variety of engineering and materials research applications.

CivilFEM powered by Marc includes a comprehensive finite element library with no practical limit to the number of elements allowed in your analysis. CivilFEM powered by Marc provides an extensive set of material models to represent the nonlinear behaviour of metals, composites, elastomers, soils, rocks, concretes and other non-metallic materials, including capabilities to model plasticity, creep, shrinkage and other nonlinear properties.

The material models can be temperature dependent and also allow for isotropic, orthotropic, and anisotropic behaviour.

Temperature, conduction, convection and other heat transfer time dependent boundary conditions can be prescribed, as well as unique capabilities for handling joints, contacts, seepage and heat transfer-structural analysis.

The wide range of nonlinear modelling and analysis capabilities in CivilFEM powered by Marc helps engineers innovate with construction and manufacturability new process in mind and enables the successful development of cost effective products and projects. Typical example applications include:

- Any nonlinear staged construction analysis
- Nonlinear buckling
- Nonlinear reinforced concrete
- Industrial Buildings, Skyscrapers, Stadiums
- Seismic Calculations
- Thermal and Wind Power Stations
- Off shore and Naval and Marine Structures
- Bridges (Concrete, Steel, Composite…)
- Prestressed Concrete Structures
- Tunnels
- Foundations (Slabs, Piles, Walls, etc.)
- Geotechnical Problems
- Dams (Concrete, Loose Materials, etc.)
- Suspension and Cable Stayed Bridges, singular Buildings
- Quality Control, Forensic, Valuation and Modification of Civil Works
- Etc.

Capabilities

- Advanced nonlinear materials models.
- Industry proven multibody contacts to accurately simulate construction joints and different materials or model parts contacts.
- State-of-the-art iterative solvers and parallel processing on shared memory machines.
- Joint & connections generators to analyse and simulate flexible joints between structural parts.
- Advanced analysis of metals, concretes, soils, rocks and composite structures.
- Predict cracking and crack initiation and propagation under realistic load conditions.
- Totally customizable and flexible units and parameters.
- Python script programing.
- Advanced stationary and transitory heat transfer and seepage analysis capabilities.
- Specific civil engineering features.
- Integrated solutions of nonlinear structural, thermal and seepage.

Benefits

- Shorten the design optimization, while improving the construction process and project performance through nonlinear real world simulation.
- Reliable and specialized analysis capabilities to reduce time of design, development, construction process, manufacturing and costs.
- Robust solver technology that greatly enhances the value of nonlinear solutions encountered in many industries.
- User friendly and easy to learn.
- Object oriented architecture.
- Multidisciplinary: only one software for all your structural and civil engineering needs.

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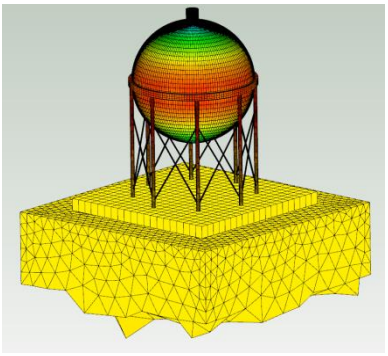
CivilFEM

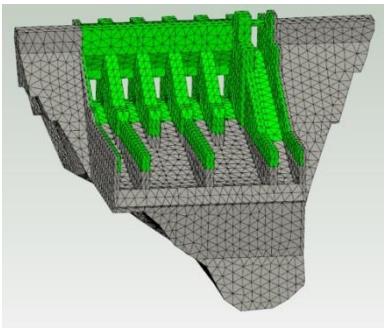
Powerful Automatic Multibody Contact Analysis

CivilFEM powered by Marc features the industry´s most advanced 2-D and 3-D capabilities to model contact between bodies or model parts. Contact between deformable bodies/objects (collections of elements) and rigid bodies (geometric entities); contact between multiple deformable bodies/objects, self-contacting bodies/objects, and interference fit analysis are automatically solved with no limit to the number of contacting bodies/objects. Unlike other programs that require the user to manually sort and pair-up individual contact surfaces or gaps elements, CivilFEM powered by Marc allows the user to simply select and entire body/object and it will automatically track the contacting surfaces and tying constraints of contact. Nonlinear contacts with friction, breaking-glue and/or cohesion are allowed with any type of analysis.



High-performance Parallel Computing Simulation

The HPC method provided by CivilFEM powered by Marc is a high performance parallel processing algorithm that runs on shared memory computing platforms. With HPC, the solver will automatically split a large-scale model into as many individual domains as CPUs, minimize the run time communication and simulate the entire FEA process in parallel.

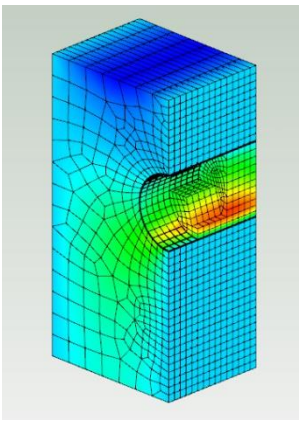


Pre- and Post-processing Flexibility and Ease-of-use

A full range of specific tools for checking and design according to civil engineering international standards and codes, capabilities for the visualization and interpretation of analysis results are provided by CivilFEM powered by Marc, the friendly and Multilanguage interactive graphical user interface (GUI) specially built for CivilFEM powered by Marc makes the program easy to learn and use.

Construction of High-quality finite element meshes can be created directly or automatically derived from geometry. CAD geometry and finite element data can be imported from leading modelling systems and easily edited in any coordinate system.

Furthermore, CivilFEM powered by Marc also allows users to customize its GUI and the user friendly environment for enhancing productivity and make it much easier to learn.

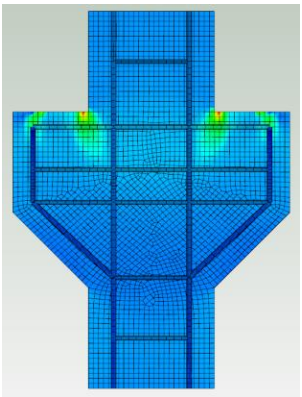


Boundary Conditions to be defined on the geometry and/or on the finite element mesh. Multiple analysis jobs can be initiated, controlled and monitored, and post-processing graphical controls and plotting capabilities allow you to show the results in a really optimal and attractive way.

With CivilFEM powered by Marc GUI and tools, you have the pre and post-processing flexibility to create and analyse comprehensive models for nonlinear FEA in the Civil engineering, Mine, Power Generation, Shipbuilding, Water, Nuclear and AEC industries.

Open and Customizable Approach to Advanced Problem Solving and Enhanced Productivity

CivilFEM powered by Marc allows you to define parameters and customize loads, boundary conditions (using scalar and vector values or equation inputs), and material properties (user define material properties including cracking data to implement different constitutive equations of materials), through versatile non-linear laws.



A table input capability provides a flexible and easy alternative for specifying loads and boundary conditions and applying material properties and load history models. Continuous functions and parametric input can be specified to improve accuracy and reduce the size of the input file.

CivilFEM powered by Marc supports the use of the Python scripting language to give you access to the database and customize the program flow. There is an automatic file log or macro recording option, which creates in Python language every single input command and step, which has been taken in CivilFEM powered by Marc. The Python script is a highly useful tool that allows the user to develop macros with parameters, data changing and logic user process.

The CivilFEM powered by Marc product family is supported on all Windows platforms and can run on shared memory computing architectures.