



# SOFTWARE

## MARINE & OFFSHORE



*Move Forward with Confidence*

**BUREAU  
VERITAS**

# Software Solutions



## SOFTWARE FOR NAVAL ARCHITECTURE

### MARINE & OFFSHORE SOFTWARE TOOLS

Our solutions will help you to reduce costs both in design and operational phases. They are the result of our own research activity with a constant focus on providing user-friendly tools. Major software are connected either to rules (IACS, BV...), regulations or industrial standards and can be used in various fields of the marine & offshore industry.

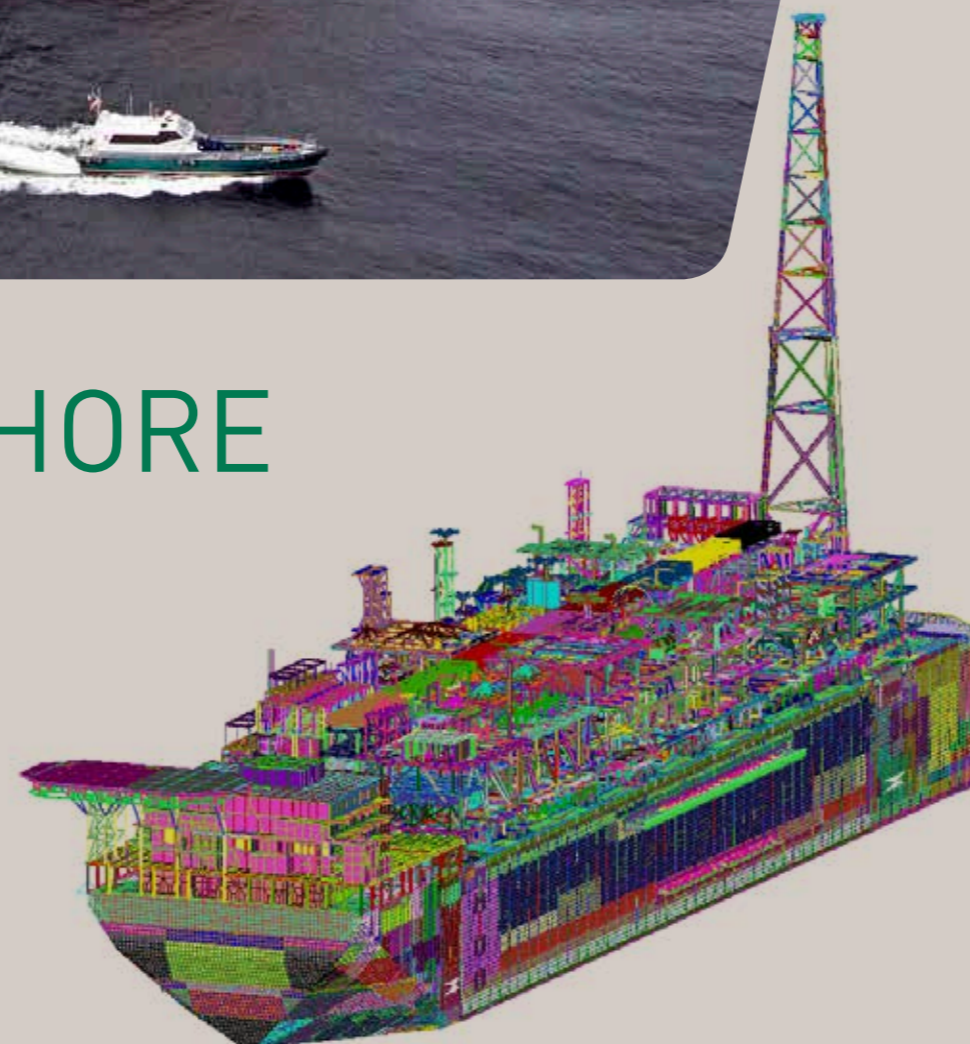
### DEDICATED TEAMS IN THE WORLD

Our software programs are supported by teams of experienced developers and engineers who use the software daily. Local technical teams are set around the world in order to provide you with the most adapted services.

## MARINE & OFFSHORE

Bureau Veritas is a leading classification society and a trusted partner to the shipping industry since the early 19th century. What makes us different? The technical expertise we offer, and our deep commitment to the marine and offshore sectors.

Bureau Veritas Marine & Offshore Department provides a large variety of software solutions enabling to comply with regulatory requirements and to optimize your design.



**HYDROSTAR**

**ARIANE**

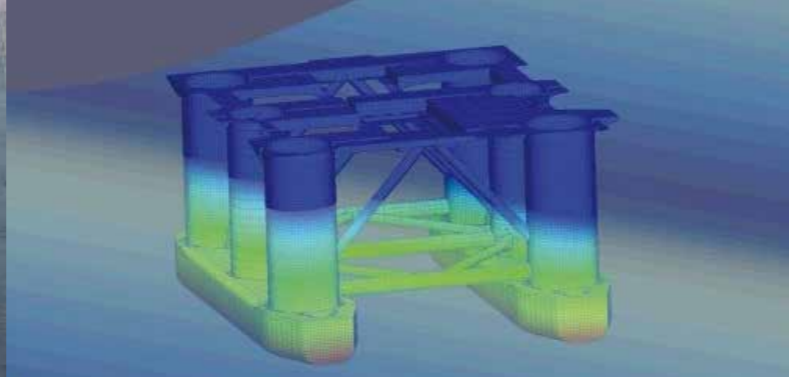
**HOMER**

**VERISTAR HULL**

**VERISTAR STABILITY**

**MARS**

**STEEL**



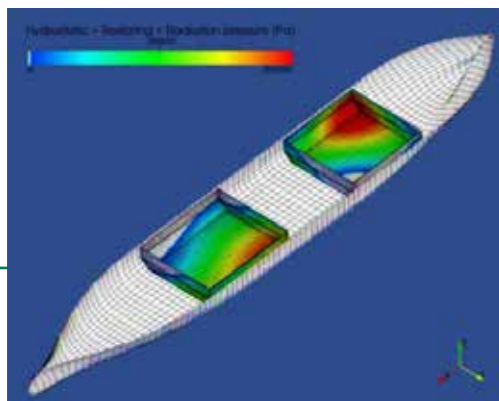
# HYDROSTAR

## SEA-KEEPING ANALYSIS

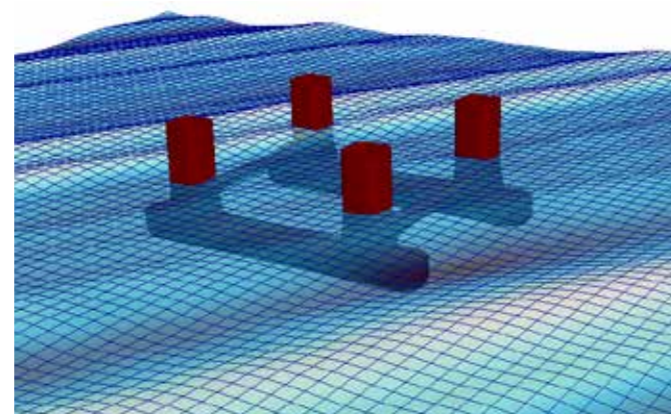


HydroSTAR is an advanced hydrodynamic software. It benefits from more than 25 years of development and is continuously updated and improved to raise technological challenges. HydroSTAR has been extensively tested and validated through comparison with semi-analytical studies, numerical results from recognized tools and experimental data.

### THEORETICAL BASIS



- Fairly perfect fluid (dissipation introduction)
- First-order and second-order potential theory
- 3D Boundary element method (panel method)
- Most efficient algorithms for associated green functions
- Deep water and finite-depth water
- Encounter frequency approximation for forward speed
- Frequency domain.



#### Main inputs:

- Hull geometry represented by flat panels
- Mechanical properties
- Wave data
- Additional viscous damping, inertial and stiffness matrices
- Forward speed.

#### Main outputs:

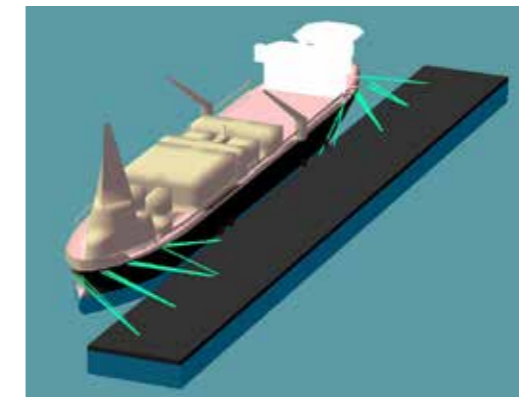
- Added Mass and wave-making Damping
- Motion, velocity and acceleration at any point of floating bodies
- Wave pressure distribution and detail components
- Wave elevations around bodies
- Hull Girder Loads RAOs
- Wave mean drift loading
- Full Quadratic Transfer Function (QTF at low and high frequencies)
- Video animations of waves/pressures/bodies' motions
- Short term and long term statistics
- Advanced design waves.

# ARIANE

## MOORING ANALYSIS



Ariane is an efficient static/time-domain multi-body mooring software developed by Bureau Veritas. Ariane benefits from thirty years of development and gathers together Bureau Veritas's extensive expertise and knowledge in hydrodynamic and mooring fields.



### CAPABILITIES

- 6 DOFs multi-body calculation in static and time domain
- Non symmetrical hydrodynamic data
- Multi-component mooring lines
- Drift loads models adapted to any water depth (Newman approximation, Full QTF, BV approximation, Wave/current interaction)
- Thrusters, external loads, fenders, buoys, sinkers, etc.
- Optional Line Dynamic Module from Wood Group Kenny
- Input data can be checked at any time analytically or graphically thanks to interactive tools

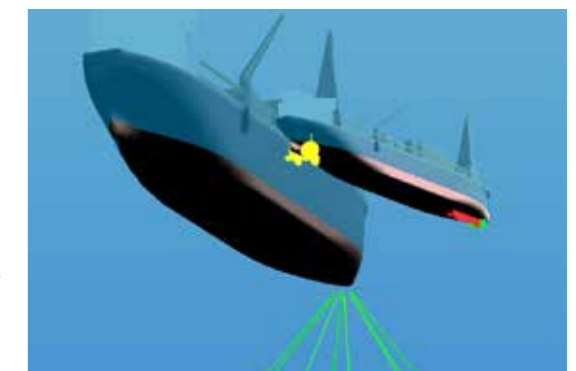
- Vessels, lines and environmental conditions stores can be created, saved and loaded separately in order to use them whenever it is useful
- No limits in the number of vessels, lines, segments, fenders...
- Turret application module
- Seabed configuration can be defined globally or for each line using input points or constant slope/water depth.

#### Static and time domain simulations:

- Time Domain Simulations performed with single cases or a set of environmental cases.
- Three types of calculations:
  - 3 DOFs low frequency + 6 DOFs wave frequency
  - 6 DOFs low frequency + 6 DOFs wave frequency
  - 6 unified DOFs (coupling between low and wave frequencies).

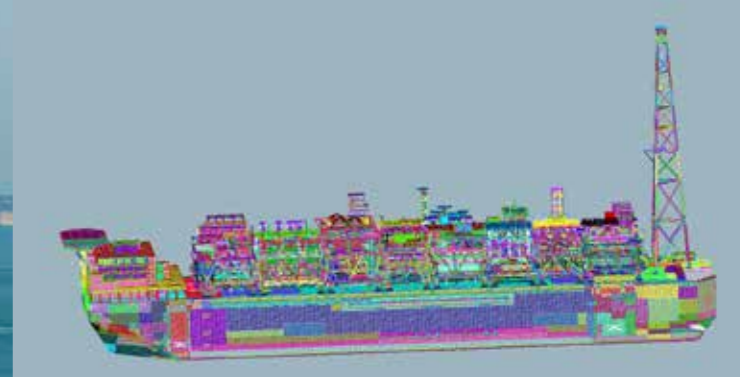
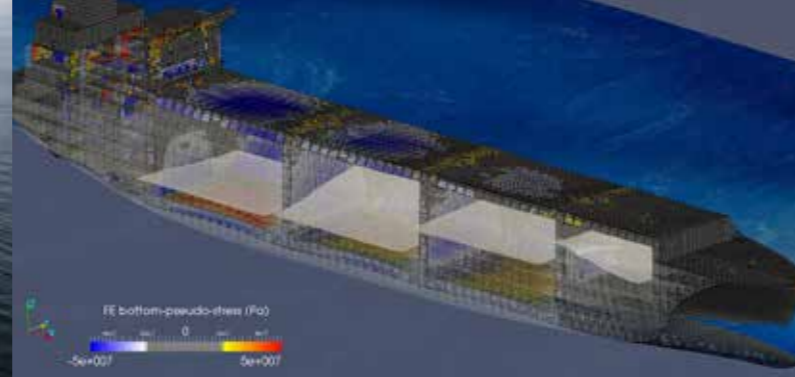
#### Simulation results:

- Displayed on the interface graphically (position of the vessels, tension in the lines, line profile...)
- Fatigue analysis
- 2D and 3D display of the mooring configuration showing all kinds of results (body motions, mooring line profiles and tensions, offsets...)
- Fully Integrated Post-processing module.



#### Dynamic positioning module:

- Fully integrated DP module
- Static (Capability plots) and time-domain simulations.



# HOMER

## HYDRO STRUCTURE ANALYSIS

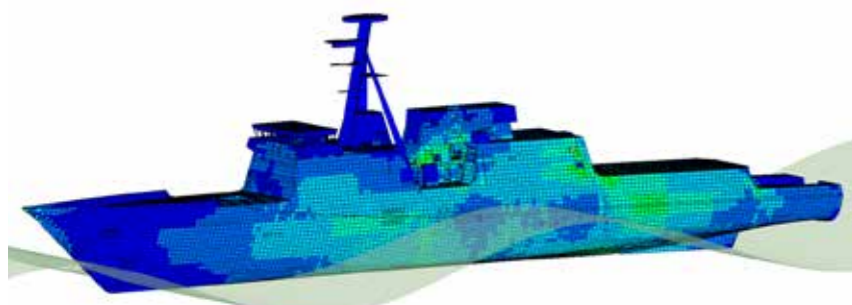
Homer is the Bureau Veritas software for direct hydro-structure calculations, i.e. for the computation of the structural response of a floating unit facing given wave conditions.

It is based on an advanced coupling method developed in Bureau Veritas Research Department, and interfaces a hydrodynamic solver (Hydrostar) with a structural solver (NX Nastran, MSC Nastran, Ansys or Abaqus).

### HOMER CAN PROVIDE:

Structural response to extreme loading cases for yielding and buckling checks (regular or irregular design waves, irregular sea-states).

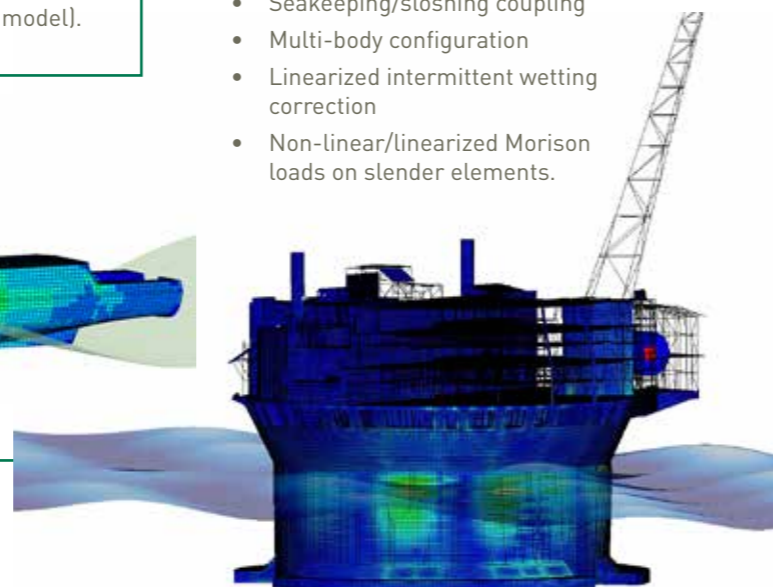
Fatigue life of structural details, using an automated top-down procedure (transfer of deformations from global to local model, and recalculation of pressures on the local model).



On the structural part, the coupling method used in Homer ensures a perfect balance of hydrodynamics pressures and inertia loading. The response of the structure can be considered either quasi-static (it does not influence the hydrodynamic loads) or dynamic; in this case, it is based on a modal decomposition and makes it possible to consider the hydro-elastic coupling (springing of container ships for example).

### On the hydrodynamic part, Homer uses the following theoretical approaches:

- Linear seakeeping loads on structure, hull and tanks (solved in frequency domain)
- Nonlinear Froude-Krylov pressure correction (solved in time domain)
- Seakeeping/sloshing coupling
- Multi-body configuration
- Linearized intermittent wetting correction
- Non-linear/linearized Morison loads on slender elements.



Any type of floating structure can be analyzed: ship-shaped structures (FPSO, container ship, LNG carrier...), FPSO, spar, semi-submersible, TLP or round-shaped offshore platforms...

# VERISTAR HULL

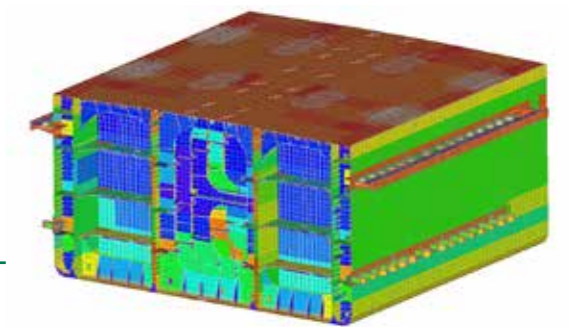
## FEM STRUCTURAL ANALYSIS

VeriSTAR Hull is the Bureau Veritas rule tool to perform analysis based on three dimensional models using finite element calculation method.

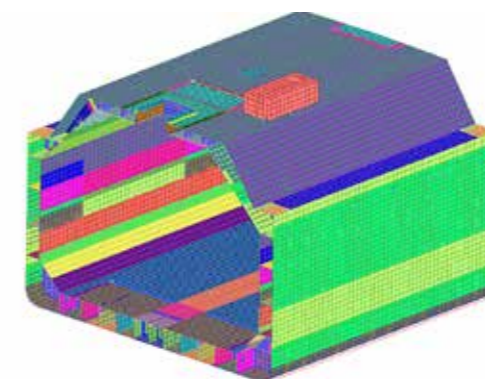
During the development of the VeriSTAR Hull solution, a lot of attention has been given to reduce the time needed for the pre- and post-processing.

### VeriSTAR Hull is able to deal with the following Rules, using the latest edition:

- CSR-H for Bulk Carriers & Double Hull Oil Tankers
- CSR for Bulk Carriers
- CSR for Double Hull Oil Tankers
- BV Steel Ships
- BV Offshore Units.



Our finite element software tool VeriSTAR Hull combines the well-known FEMAP processing tool and the proven NX and MSC Nastran solvers with in-house developed features for fast and efficient modelling and results assessment.



### VeriSTAR HULL offers open solutions for finite element analysis proposing a step by step procedure within a user-friendly interface:

- Generation of 3D finite element model
- Mesh quality check tool
- Automatic buckling panel analysis
- Lot of powerful automatic processes to ease use and speed the model analysis (corrosion addition application, load calculation, balancing) for all regions
- Yielding and buckling post-processing according to selected rules criteria
- Dedicated interface to perform the post-processing combined with an efficient tool to identify easily the critical location and the associated loading condition
- Full integration of the sub-modeling approach available for local yielding and fatigue analysis.



# VERISTAR STABILITY

## STABILITY ANALYSIS

VeriSTAR Stability is a three dimensional program intended to calculate intact and damage stability together with longitudinal strength. Its user-friendly interface uses the most advanced graphic interactive methods.

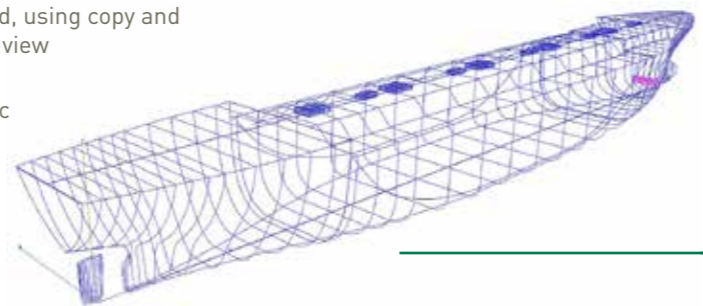
The software comes with a self-training program and a set of tutorials.

### FAST MODELLING

Definition of hull shape may be done directly by keyboard, using copy and paste commands or by mouse after import of lines plan view as background image.

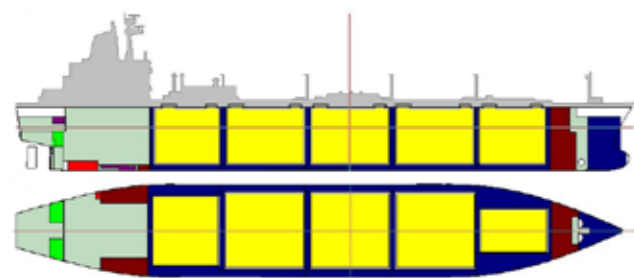
Appendages are created from a large range of geometric primitive shapes.

3D approach allows for creation of model with minimal amount of data.



### Data input & modelling includes:

- Capacity plan
- Light ship distribution
- Management of containers including EDIFACT file import.

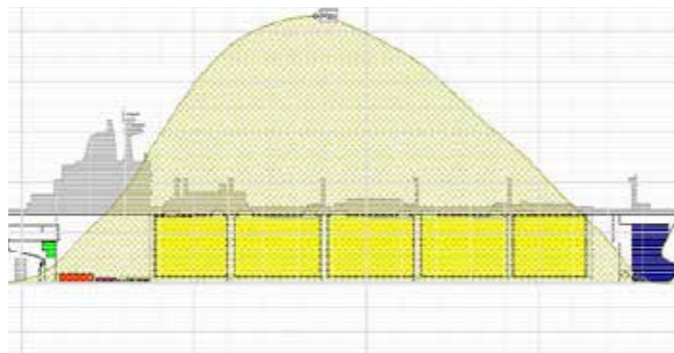


### Intact stability and strength includes:

- Maximum permissible KG
- Maximum permissible grain shifting moment
- Water trapped on deck according to Torremolinos agreement.

### Damage stability includes:

- Calculation of GZ Curves (including calculation of water trapped on deck for Ro-Ro passenger vessels)
- Permissible lengths
- Grounding and re-floating tool
- Damage strength distribution.



# MARS

## 2D STRUCTURAL ANALYSIS

The MARS family is a group of several software to perform the assessment of 2D prescriptive requirements for over twenty different types of ships.

### Software tailored for BV Rules:

- Mars2000 is available for Rules for Steel Ships, Offshore Units, Polar Class & Icebreakers and IACS Common Structural Rules for Bulk Carriers & Oil Tankers, etc.
- MarsMili is available for Rules for Naval Ships
- MarsInland is available for Rules for Inland Navigation Vessels
- MarsNG is available for Rules for Container Ships.

### A COMPLETE PACKAGE THAT COVERS THE REQUIREMENTS FOR:

- Global strength criteria (yielding, ultimate)
- Local scantling (minimum, yielding, buckling) of strakes, longitudinal and transverse stiffeners for cross sections
- Fatigue calculations of connections between longitudinal stiffeners and primary structure
- Local scantling (minimum, yielding) of strakes and secondary stiffeners for transverse bulkheads
- Specific assessments as:
  - for BV Container Ships: Including torsion effects in the local criteria
  - for IACS CSR: Residual strength, grab load and side frames assessments for Bulk Carriers, assessment of the Primary Supporting Members ring for Oil Tankers, etc.



Being fast and with user-friendly input and results interface, MARS allows to perform quick assessments of great quality. MARS is free of charge and free of access.





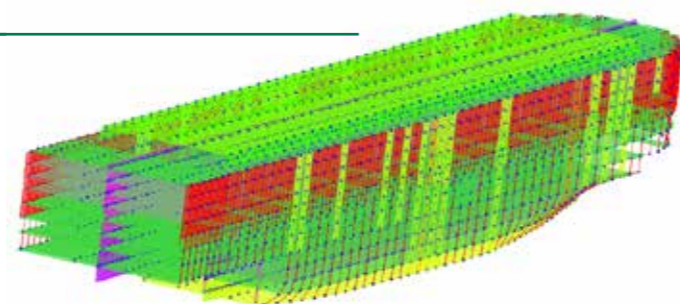
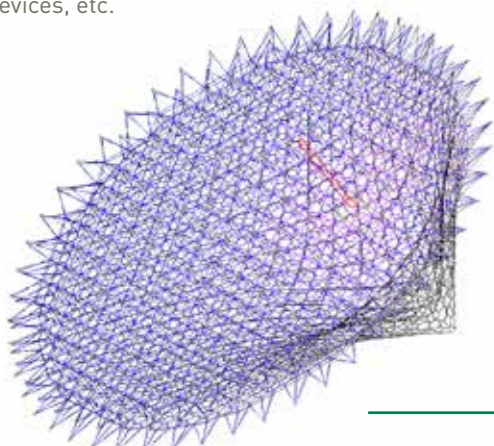
# STEEL

## 3D BEAM STRUCTURAL ANALYSIS

STEEL is a 3D beam analysis program based on the displacement method. It calculates all deformations, local forces, moments and stresses in 3D frames modelled by beams and submitted to static and thermal loads.

### VERSATILE MODELS

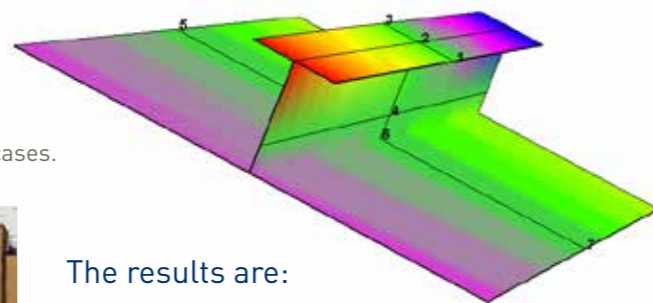
STEEL is used for a wide range of studies in the Marine & Offshore environment regarding primary structure, framing, decks, pillars, grillage assemblies, cranes and elevating devices, etc.



STEEL provides many types of standard beam profiles as well as the possibility to define custom ones; node degrees of freedom can be adjusted. It includes beam axial and torsional rigidities, additional beam deformations due to shear forces and beams with rigid ends. The centre of shear can be different from the centre of gravity. STEEL is completely interactive with a finely configurable 3D view of the structure to display data and results.

#### Possible loads are:

- Structure own weight
- Concentrated and linear beam loads
- Hydrostatic loads
- Thermal loads
- Combination of loading cases.



#### The results are:

- For each node:
  - displacements
  - reactions.
- For each beam:
  - deformations
  - local shear forces and bending moments
  - normal, shear and Von Mises stresses.



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