esas.07 Tension only members

Analysis of the structure with the possibility to define members capable of resisting only to tension or compressive forces or a limited compression or tension. A practical application of it is the elimination of compression in wind bracings.

esas.08 Pressure only support or soil

Analysis of the structure with the possibility to define unidirectional supports for nodes or members.

esas.09 Non-linear springs, gaps

Analysis of the structure with the possibility to define non-linear springs in supports or internal nodes (e.g. semi-rigid connections) and gap elements (e.g. members resisting forces only as of a certain elongation).

esas.10 Geometrical nonlinear

Second order calculation of constructions. Includes the calculation of the structure in deformed condition, taking into account the P-Delta effect (initial displacements and member imperfections) as well as the influence of normal forces on the stiffness. Calculation methods Timoshenko (for structures with a constant N-force during the calculation) and Newton-Raphson with gradual application of the loads (for larger displacements and variable N-force during the calculation).

esas.11 Geometrical nonlinear analysis surfaces

Second order calculation of plate structures, taking the deformed condition (geometric imperfections and initial deformations) into account.

esas.12 Cable analysis

Calculation of the construction taking cable elements with possibly prestressing into account. Possibility to input a curved start form for the cable. The final curvature of the cable will be calculated depending on the equilibrium with the loads and the prestressing.

esas.13 Stability analysis of frames

Definition of the global buckling modes and buckling loads of the member construction. Starting from the value obtained for the buckling load, the user can decide to proceed to a second order analysis or not. The critical buckling mode can be imported in the geometric non-linear calculation as an initial deformation (esas.10 module).

esas.14 Stability analysis of surfaces

Definition of the global buckling modes and buckling loads of the plate construction. The critical buckling mode can be imported in the geometric non-linear calculation as an initial deformation (esas.11 module).

esas.15 Plastic analysis steel structures

Analysis of plastic hinges for steel structures according to EC, DIN, NEN, ÖNORM or CSN.

esas.34 Non-linear stability analysis

Definition of the global buckling modes and buckling loads of the member construction, non linearities such as members only traction/pressure, non-linear springs… Starting from the value obtained for the buckling load, the user can decide to proceed to a second order analysis or not. The critical buckling mode can be imported in the geometric non-linear calculation as an initial deformation (esas.11), (extension of module esas.13).

esas.37 Membrane elements

Calculation of shells as 2D-elements with tensile axial stiffness only.

Datasheet Scia Engineer

esas.07 / esas.08 / esas.09 / esas.10 / esas.11 / esas.12 / esas.13 / esas.14 / esas.15 / esas.34 / esas.37

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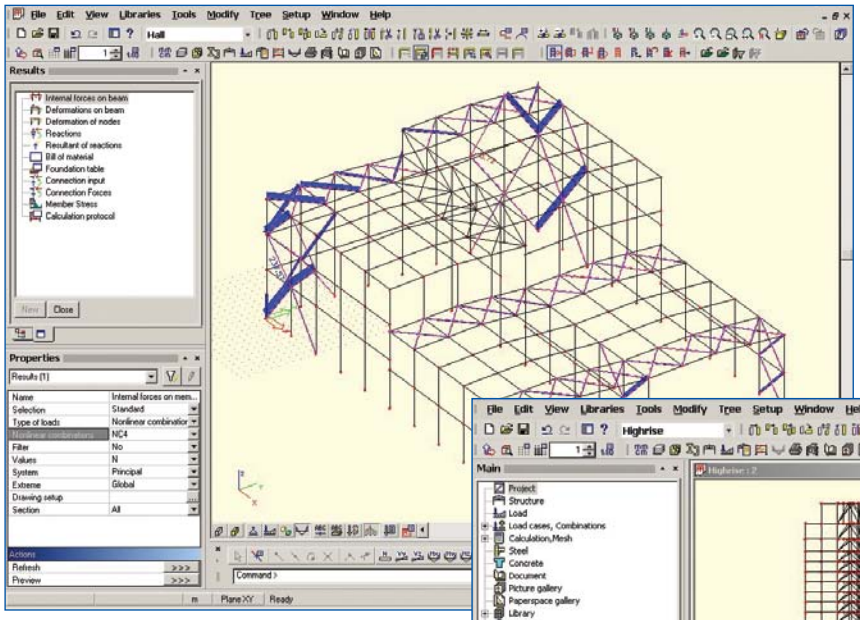
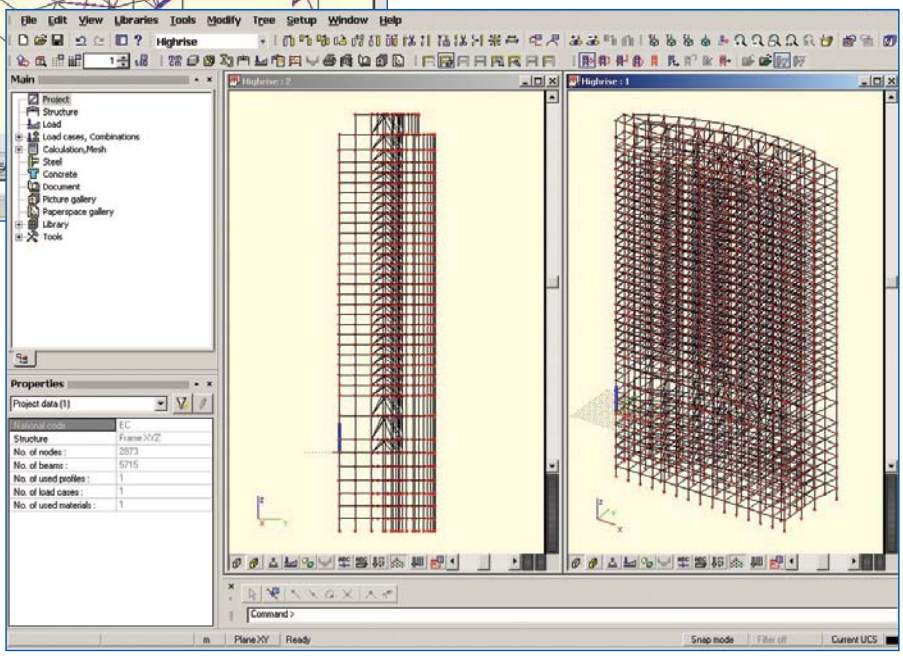
Tension only members / Pressure only support, soil / Non-linear spring, gaps/ Geometric nonlinear analysis / Cable analysis / Stability analysis / Plastic analysis of steel structures





Advanced calculations

The Scia Engineer program offers extensions to standard linear calculations that can generate more complicated but more realistic models of structures. These calculation methods reflect the latest trends in steel construction design. The Scia Engineer environment makes it easy to apply these integrated features.
The use of these features is completely integrated into the Scia Engineer environment and therefore it is really easy to apply them.

Tension only members

This module enables the calculation of models that have the following physical nonlinearities:

- Tension only members;
- Pressure only members;
- Members with limited tension and compression forces.

"Tension only" members act only when the applied load causes extention and consequently tension. The user can also work with beams in pressure only mode: in such cases the beam will only act in the structure when there is pressure.

Highlights

- Easy-to-use modelling of special types of structural members.
- Simple application of special types of analysis.
- Second order and stability calculations.

What's New

UPDATED

- Possibility to run multiple analysis (linear, non-linear, modal) in a batch.
- Local Mesh Refinement for nodes.

Engineers generally define the marginal force as the upper limit for the member to be active.

Pressure only supports/soil

One-sided supports - that act only if the structure undergoes pressure - can solve any contact problems. The other corresponding direction is free.

The use of local node and beam coordinate systems can create one-sided supports in any direction. This feature is also available for line supports.

Non-linear spring/gaps

This module enables the calculation of models that have the following physical nonlinearities:

- Non-linear springs for supports and internal hinges;
- Gap elements, e.g. elements taking normal force after an elongation of 10 mm.

Geometrical non-linear analysis

The geometrical non-linear (or second order) analysis technique can facilitate any calculations on the structure in the deformed state, and can take the secondary effects of any deformation into account. The P (axial load) and delta (horizontal deflection) multiples will mean that lateral loads (such as wind loads) in combination with applied vertical loads will generate additional moments. The second-order effects are local or member second-order effects, and are known as P-d and global second-order effects, referred to as P-D effects.

- Influence of normal force on stiffness ("stress stiffening");
- Geometric imperfections (initial deformations and member imperfections).

Two geometric non-linear solution routines offer an optimal solution for every challenge in advanced structural engineering.

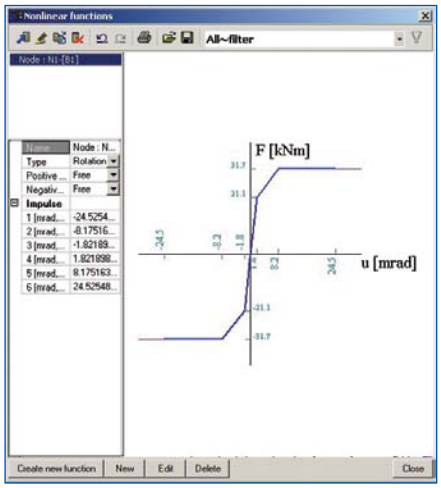
They are as follows:

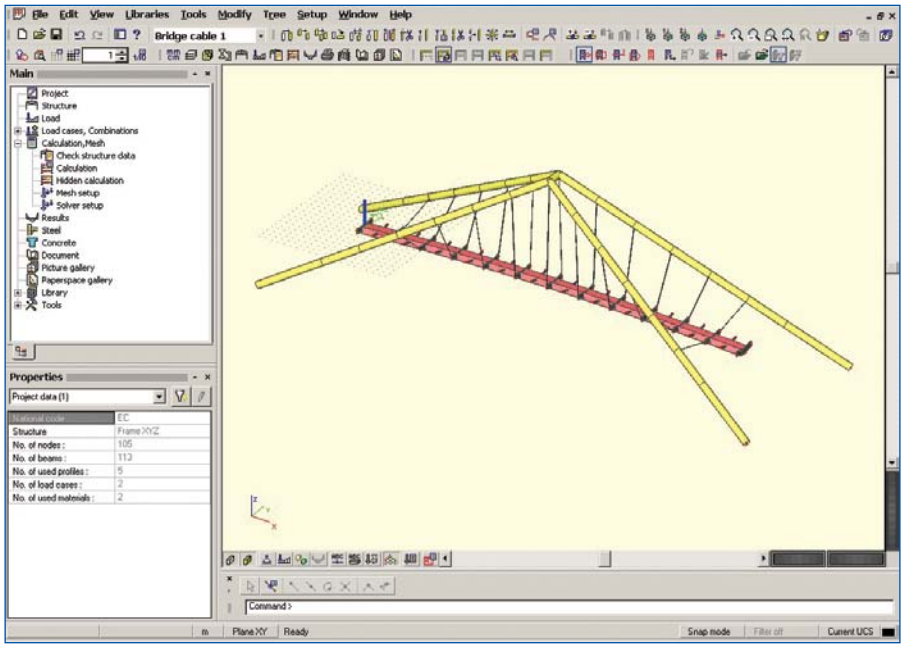
- The Timoshenko method can assess building structures with small horizontal deformations where the normal force in the elements remain constant during second-order calculations;
- The Newton-Raphson algorithm method determines effects under gradually applied loads.

esas.07, esas.08, esas.10, esas.11 included in C P E esas.09, esas.13, esas.14, esas.15 included in P E esas.12, esas.34, esas.37 included in E

esas.07 / esas.08 / esas.09 / esas.10 / esas.11 / esas.12 / esas.13 / esas.14 / esas.15 / esas.34 / esas.37

Required modules: esas.00, esas.01.





This method is optimal for structures with significant deformations, where the normal force in the elements changes during calculations.

Cable analysis

This module introduces the possibility of more precise cable analysis. It can take account of the initial curve of the cable catenary, which is in a state of equilibrium even though it is subject to loading and stress.

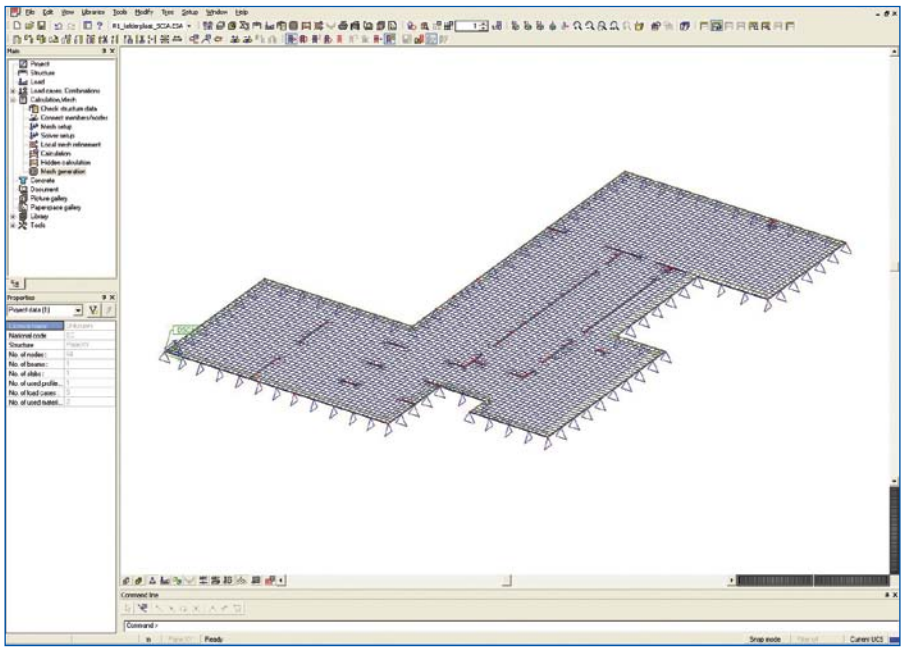
Membrane analysis

The membrane calculation enables analysis of shells considered as 2D surface elements with only tensile axial stiffness.

Stability analysis

This module helps to determine the global buckling modes and buckling loads of the structure. The user chooses the number of buckling modes to be calculated, using the subspace iteration method to determine the buckling load. Sturm checking can assess the completeness of the results.

Non-linear stability analysis determines any structure instability in two stages. The first stage increases loads incrementally to the point of structure instability, with calculations taking any non-linear effects into consideration. The second stage of this analysis procedure determines the buckling mode and buckling loads with high precision.
If the engineer knows the buckling load he or she can determine for each structure whether a second order calculation is required. The building codes provide the maximum figures for using first order calculations, in terms of loading and buckling loads.



Engineers can derive the critical initial deformation for a second order calculation from the global buckling mode of the structure.

Plastic analysis of steel structures

In terms of the analysis of steel structures with plastic hinges (plastic - plastic analysis), Eurocode 3, DIN 18800 and NEN 6770 standards provide the interaction formulas between shear force and plastic moment.

When the load causes a cross-section at any point in the structure to reach plastic moment, the program inserts a plastic hinge in this position. Large structure calculations form the basis for the algorithm used.

Each iteration involves testing and processing of all the members. Engineers can convert back the figures for beams that fulfilled the conditions in previous iterations to those for the initial conditions, when the state of the structure requires them for further iterations. The procedure is iterative and converges to an exact solution.