BTII+

Lateral Torsional Buckling Analysis

BTII+ performs structural safety analyses on straight steel bar systems with any type of supports. Verifications can be performed either as second order buckling torsion analysis or in accordance with the equivalent bar method on the basis of ideal bifurcation loads. The ideal bifuraction loads are determined numerically on the entire system. They are calculated separately for each of the failure modes lateral buckling and lateral torsional buckling.

Standards

- DIN EN 1993
- ÖNORM EN 1993
- BS EN 1993
- EN 1993

Special applications

In addition to the general structural safety analyses on straight bar systems, we like to point out the following special applications:

- Purlins, ledgers and columns stiffened with bracings or trapezoidal steel sections and similar reinforcements.
- Craneway beams (with or w/o
- horizontal bracing)
- Analysis of secondary flange bending stresses at eccentric loading on the lower flange by suspension cranes or underslung trolleys
- Determination of the ideal bifurcation loads for the calculation of buckling slenderness ratios in concrete and timber construction

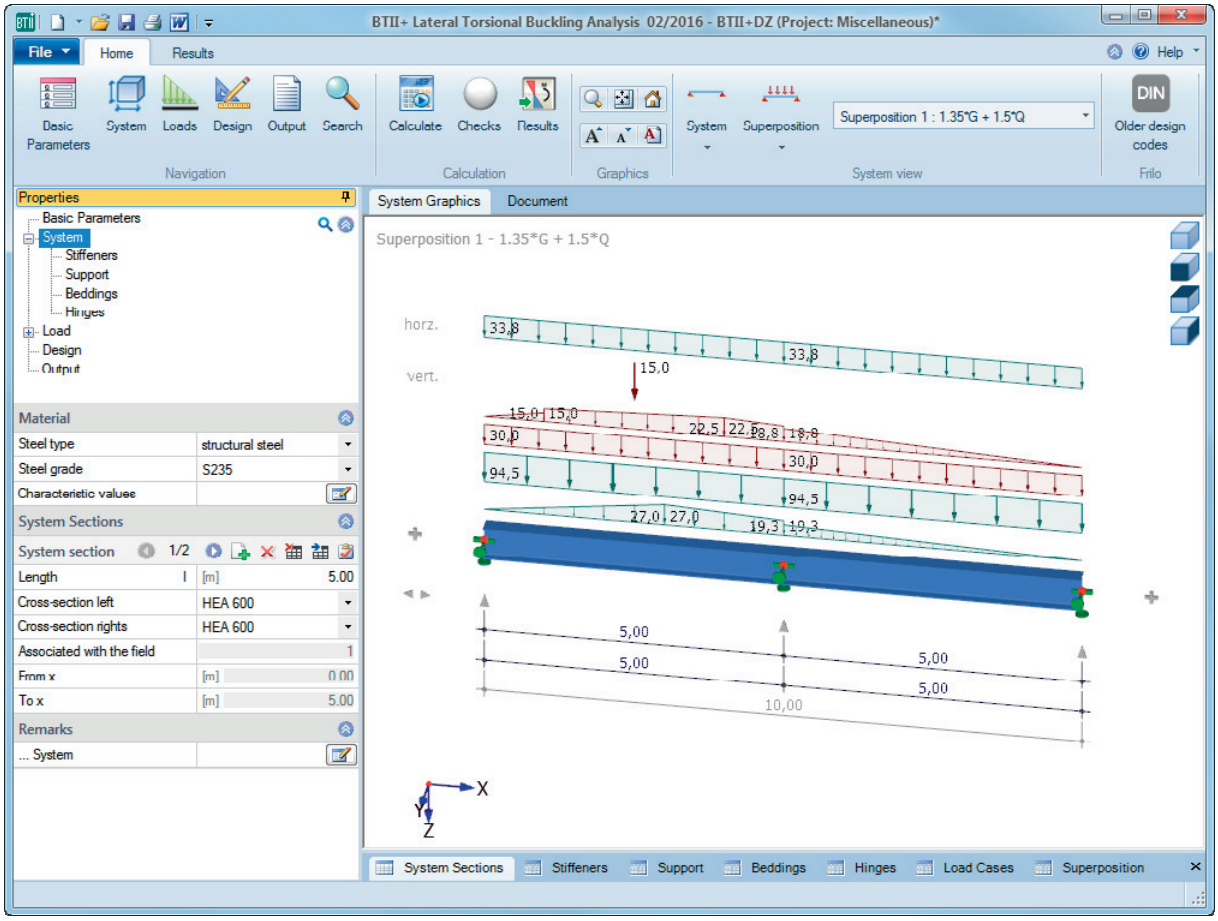
Calculation

BTII+ calculates the internal forces and the deformations with consideration to warping torsion as well as the ideal bifurcation loads, the slenderness ratios and the reduction factors for the stability verification in accordance with the equivalent bar method.

Analyses

The verification of the cross sectional resistance is performed either on the basis of

- equivalent stresses
- plastic limit internal forces or
- in accordance with the partial internal forces method by Kindmann.



The load bearing capacity of the system is verified either

- via the inclusion of the internal forces in a second order buckling torsion analysis or
- in the form of an equivalent bar verification.

Cross sections

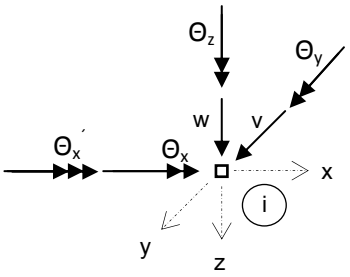
BTII+ allows you to define beams with haunches and cross sectional jumps. Available sections are

- double- and single-symmetrical I-sections with and w/o top flange angles,
- U-sections, rectangular sections,
- round and square hollow sections
- as well as any asymmetric, thin-walled open polygonal sections.

You should note in this connection that the relative location of the centre of gravity and that of the shear centre are not identical if different cross sections are used. If the system is under axial force loading, the user might be required to define bending moments in addition, due to the different locations of the centres.

Discrete supports

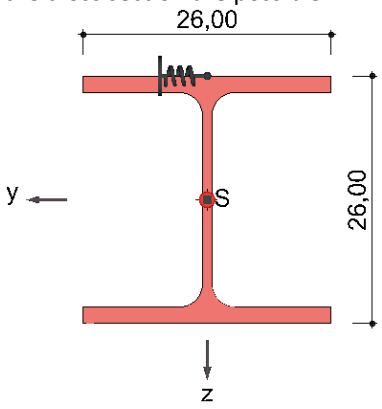
Discrete supports are configured along the beam via the specification of their x-coordinates.



Depending on the degrees of freedom at the node, the supporting conditions are defined via

- two shifts
- three rotations and
- the warping.

If translational degrees of freedom are defined as a spring parameter, distances to the reference point of the cross section are possible.



Foundations

BTII+ allows you also to describe elastic translational foundations, shear field foundations and torsional foundations.

Pinned joints

BTII+ allows the definition of shear force joints, moment joints and warping joints

Loads

The definable external loads are

- distributed shear loads
- concentrated loads in y/z-direction
- concentrated moments around the y/z-axis
- warping moments as well as
- torsional line moments.

Imperfection

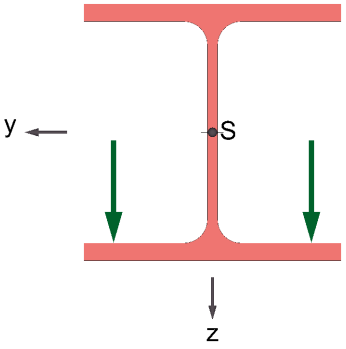
In order to take imperfection into account either in the form of initial bow imperfections in direction of the both major axes of the cross section or in the form of initial sway imperfections around the longitudinal axis, you simply need to specify the zero-points and the amplitudes of the sinusoidal or parabolic half-waves.

Moving loads

Point loads can also be classified as a load train. In this case, limit load positions can be defined. The criteria for the decisive load position are the maximum/minimum values either of the internal forces or the axial or equivalent stresses. The application performs automatically the structural safety analysis in accordance with the selected format for the decisive load position.

Local loading on beams

When underslung overhead cranes travel along the beam on wheels or trolleys, crane wheel loads or trolley loads apply eccentrically to the beam web.



These loads produce secondary flange bending stresses in the proximity of the load application point in two directions. The application calculates the stresses resulting from the local load introduction and superimposes them with the global beam stresses. This local loading can be taken into account in combination for double-T beams with or w/o top flange angles.

Coordinates for supports, springs and concentrated point loads

Section borders, discrete rigid and elastic supports, borders of foundation regions, application points of point loads, borders of line loads as well as zero-points of deformation half-waves are defined by specifying their x-coordinates.

Transfer support loads

Design values of the supporting forces can be passed to the program single-span steel column STS+ as result load cases.