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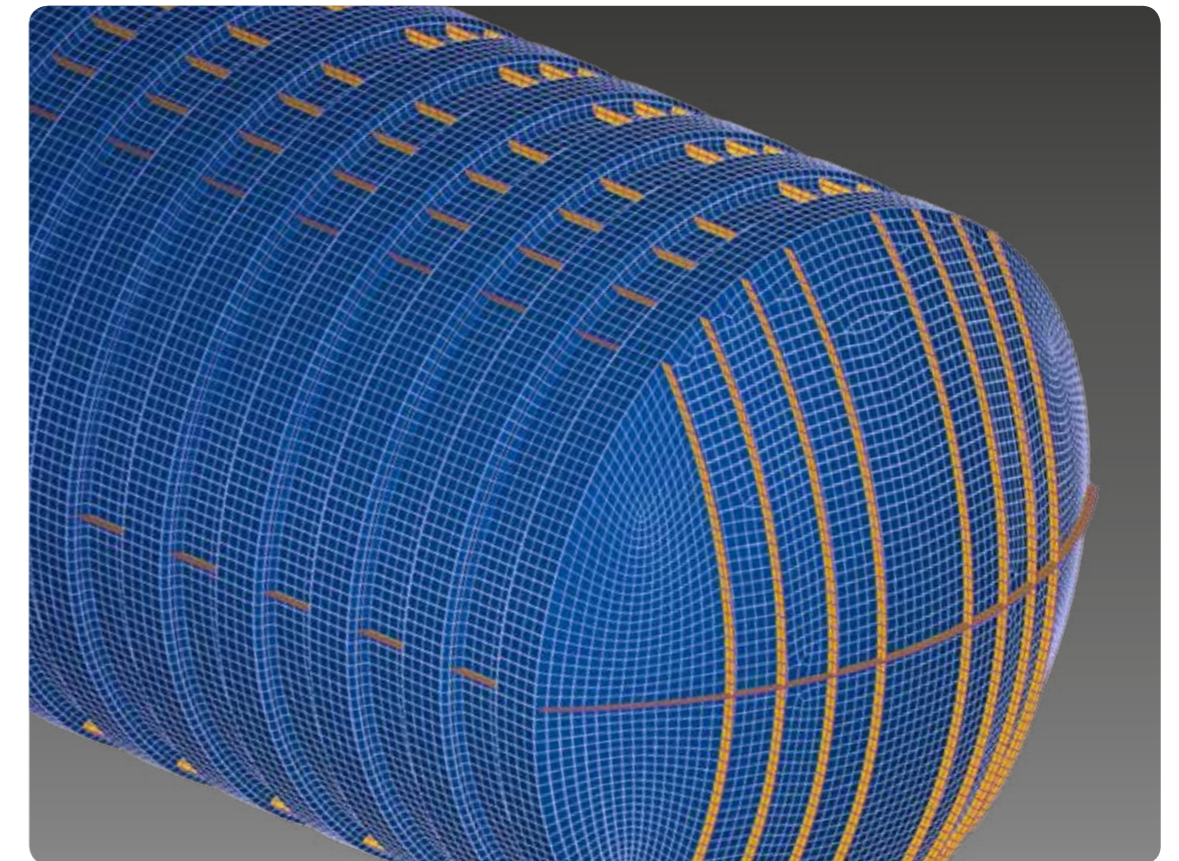
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Structural Engineering FEM Simulation

IngSoft – Your partner for finite element calculations

With many years' experience in the industry, we offer you engineering services for many structural and mechanical requirements. As a specialist in the structural analyses of pipes and manholes as well as the calculation of reservoirs and tanks, we offer a comprehensive range of services, covering all current materials. Our customers include local authorities, engineering firms, pipe, manhole and tank manufacturers in Germany, Europe and worldwide. Our cooperation with the standardisation bodies and committees guarantees state-of-the-art technology.



Services for your product development

- ✓ Modelling and meshing
- ✓ Finite element analysis (FEA)
- ✓ Non-linear contact
- ✓ Developing solutions
- ✓ Interpreting the results
- ✓ Consulting regarding verification of static calculations

Preprocessing

In the finite element program, the Data required to solve the problem are entered interactively or in the form of files. The entries can be checked graphically. The necessary input data includes:

- Geometry
- Material (modulus of elasticity, Poisson's ratio, etc.)
- Geometric boundary conditions (displacements, supports)
- Static boundary conditions (loads)
- Type of finite elements used
- Mesh generation (dividing the structure into finite elements)

Processing

In Processing, numerical implementation of the finite element method takes place. This essentially requires the following steps:

- Calculation of element stiffness matrices
- Calculation of element load vectors
- Assembly of system stiffness matrix and system load vector
- Solving the resulting equation system according to the system displacement vector

Standards

We conduct the required verifications in accordance with current standards and regulations. We perform comparative calculations and comparisons, e.g. Eurocode compared with DIN.

Applications

Underground pipelines

- Pipe racks (close laying of two or more pipelines that influence each other and therefore are no longer accessible for analysis according to the standard regulations)
- Cable outlets, cable conduits, also under the tracks of German Railways (Deutsche Bahn)
- Pipeline routes under airport runways

Sewer rehabilitation

- Liners for any cross-sections (egg profiles, mouth profiles, kite profiles)
- Host Pipe Condition (HPC) I, II and III; with grouting, wedging and checking the liners/short pipes lengthwise
- Verifying calculations for existing pipelines under actual installation conditions (e.g. lack of support due to continuous shimming)

Manhole structures

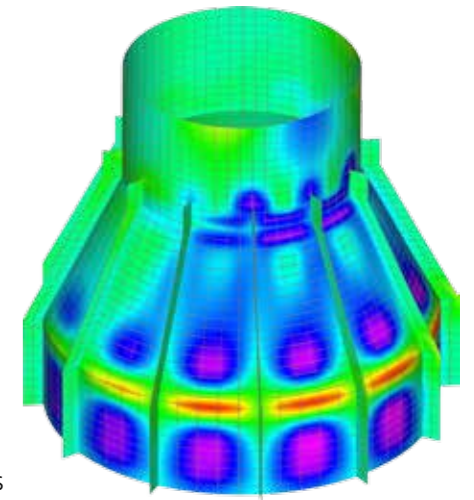
- Custom shaped parts e.g. tangential shafts
- Consideration of built-in parts, openings, outlets
- Cones made from any material, including plastic – with and without reinforcing ribs
- Any load positions specified by the client

Reservoirs and tanks

- Challenging geometry, rib reinforcements
- Reservoirs, tanks, bunkers, silos
- Optimisation of wall thicknesses

Materials

- GRP, PE-HD, PVC, metals, concretes, etc.



Do you need a special solution tailored to your specific task? We are happy to advise you!

Postprocessing

Solution and its interpretation by the engineer characterize the Postprocessing. The operations to be carried out include:

- Separation of the element displacement vectors
- Calculation of the approximated continuous displacements
- Calculation of the approximated continuous distortions and stresses
- Visualisation of deformations, strains and stresses
- Comparison with permissible values

Reports

In summary of the FEM analysis, a verifiable report is created. This may include the following, amongst other things:

- Project documents (soil surveys, sketches, plans, existing documentation)
- Literature (standards, regulations)
- The task (calculation model, load, load combination)
- Graphical representation of the stresses and deformations
- Proof of load-bearing capacity
- Proof of fitness for use
- Proposals for modification and optimisation if desired