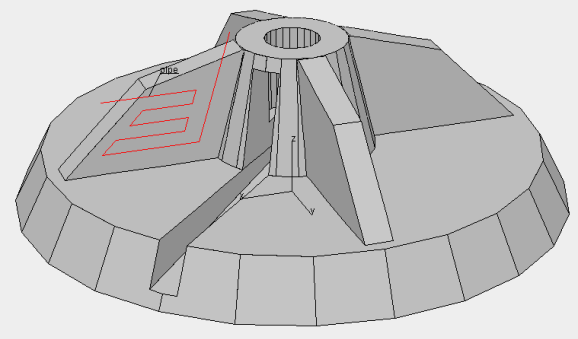
b4cast

Software for Simulation of Temperatures & Stresses in Hardening Concrete

The b4cast is advanced software for simulating the temperatures and stresses in 3-dimensional concrete structures during hardening. By means of the software structures are modeled for different construction methods in order to optimize the solution.



It is very important to be careful about the hardening process of concrete. Inappropriate construction methods can cause:

- Freezing before the concrete is strong enough
- Too early evaporation leading to a weak cover layer
- Too high temperature differences leading to crack-formation
- Lack of final strength due to too high temperatures
- Lack of strength at form-removal, prestressing or loading

In all cases the concrete structure will be directly damaged and the durability, functionality and appearance will be substantially reduced. On the other hand it is also important not to make more arrangements than necessary. By making a simulation prior to start-up of a project the risk of damages are reduced or eliminated.

The computer-program b4cast is useful for:

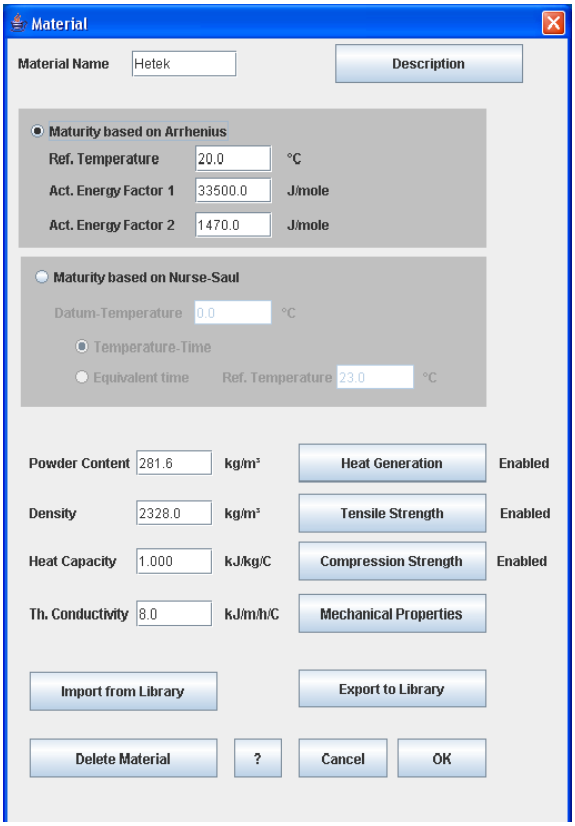
- Contractors, in planning construction methods fulfilling requirements and economy limitations.
- Consultants, during the design-phase where it is possible to check the planned activities.
- Precast industries, optimizing the production

Due to the fact that b4cast is based on the Finite Element Method and is modeling in 3D, a wide range of problems can be solved.

The computer-program is very user-friendly. No in-depth knowledge about the Finite Element Method is required. What is needed is to describe the construction method, start the calculation and check if the results are reasonable.

Construction Method

Volumes corresponding to actual castings are defined geometrically. Time of casting and the casting temperature are defined. Scheduling of cooling pipes/heating wires is possible.



Materials

The hardening concrete is described by:

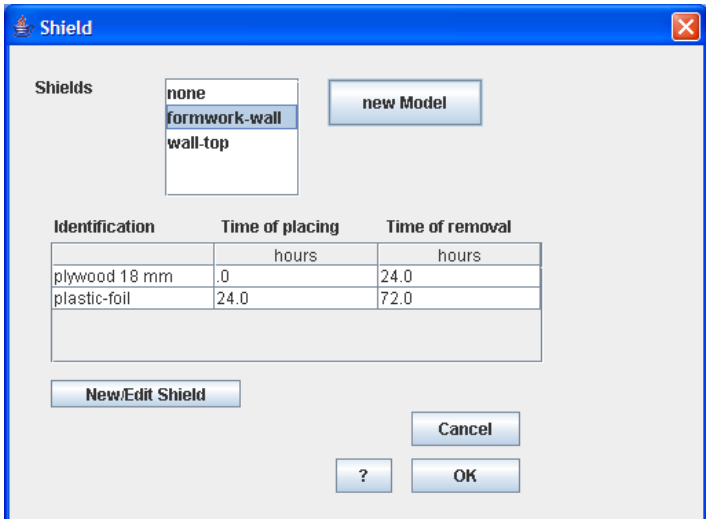
- Activation Energy/Datum Temperature/Ref. Temperature
- The Heat of Hydration
- Cement Content
- Heat Capacity
- Density
- Thermal Conductivity
- E-modulus
- Poissons ratio
- Thermal expansion
- Eigen-strain
- Creeping
- Tensile Strength
- Compression Strength

Maturity is based on Arrhenius or Nurse-Saul functions.
Materials can be imported from and exported to libraries. In this manner the same material can be reused in different jobs. Together with the software are delivered examples on materials, which are ready to use.

Thermal Boundaries

The following models can be assigned to surfaces:

- Temperature related to convection
- Wind-speed
- Shields: user defined formwork/insulation etc.
- Flux
- Temperature related to radiation
- Transmission coefficient related to radiation



All models are functions of time.
Internal heating or cooling can be done by specifying **heating cables or cooling pipes** (open circuits, closed circuit and cooling plants can be specified)
Shields can be imported from and exported to libraries. In this manner the same shield can be reused in different jobs. Together with the software are delivered examples on shields, which are ready to use.

Displacement boundaries

The structure can be provided with displacement boundaries in relation to external restraints. Displacement boundaries are also used in specifying planes of symmetry.
If none or some displacement boundaries are supplied by the user, the software automatically complement boundaries in a way, which makes the structure statically determinate. Self-weight and external loads are considered.

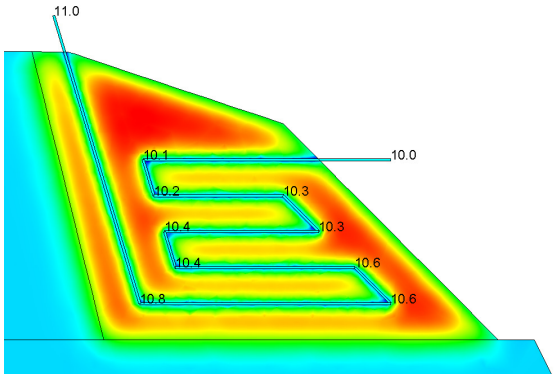
Calculation Method

The analyses (thermal- and stress-) are performed by means of the Finite Element Method. The structure is meshed into tetrahedrons. The variation of temperature, maturity and stress within the element is assumed to be parabolic within each element.

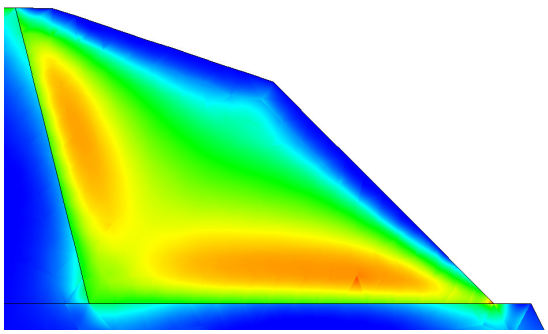
Results

Results are:

- Temperatures
- Maturities
- Tensile and compression strengths
- Stresses, Principal Stresses and exploitation of tensile strength



Results variation in space are presented as contour plots in user-defined sections
Results variation in time are presented as graphs with minimum/maximum-values, average values, or values in user-defined points.
Cross-sections with extreme values can automatically be located.



Licensing

b4cast is available as licenses with a time limit.

System Requirements

Operative systems: Windows, Linux or Solaris
Thermal Analysis: min. 1 GB RAM
Stress Analysis without cooling pipes/heating cables: min. 4 GB RAM
Stress Analysis with cooling pipes/heating cables: min. 8 GB RAM

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