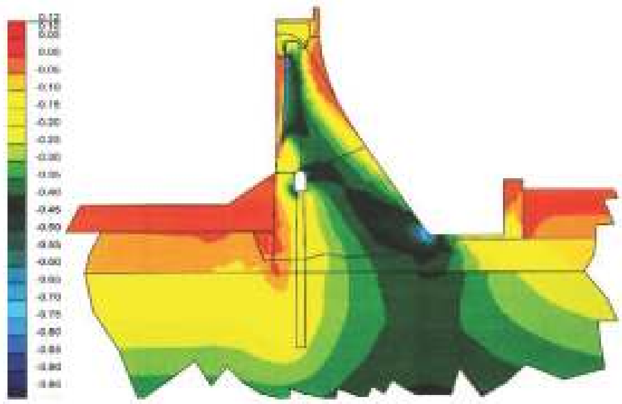
HYDRA – SOFTWARE FOR THE SOLUTION OF POTENTIAL PROBLEMS

HEAT TRANSFER PROBLEMS

SEEPAGE PROBLEMS, APPLICATION TO GROUNDWATER FLOWS

Analysis of:

- steady, unsteady and transient heat transfer problems using a wide variety of boundary conditions.
- steady, unsteady and transient seepage problems using a wide variety of boundary conditions.
- unsteady problems for the calculation of the free surface
- fully coupled problems of heat transfer, seepage flow – structural analysis – dimensioning.
- specific problems of heat transfer with solidification, chemical reactions, evaporation or consolidation.
- hydration of concrete taking into account several models from literature.



Simulating:

- groundwater flow calculations for dams or other geotechnical problems.
- fully coupled structural and thermal analysis problems in the case of fire, fire resistance for structural elements.
- coupled problems for the stress analysis of dams caused by temperature changes.
- environmental problems for the prediction of pollution in groundwater flows.

Features and capabilities of **HYDRA**:

- Solution of potential equation using the finite elements method on a unstructured grid of tetrahedral or hexahedral elements in 3 dimensional space.
- All the data and the results are stored in the data base of SOFiSTiK programs and used as loads in sequential structural analysis calculations.
- Materials properties modified during the solution procedure in relation to the developed flow or temperature field.
- The post-possessing of the results is based on the corresponding tools of the SOFiSTiK programs.
- The numerical grid is constructed by using suitable modules of SOFiSTiK programs in relation to the specific requirements of the flow problem to be solved.
- Several material laws/characteristics for the simulation of material behavior under fire conditions, based on EC1-2 or DIN4102-2, are modeled.
- Solution of internal flows in pipe networks.

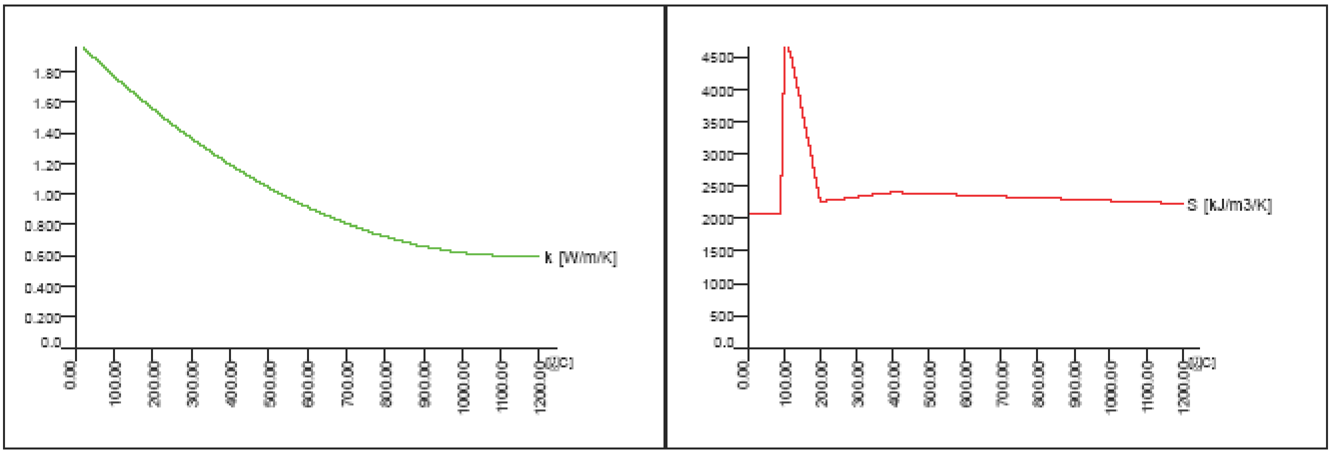


Figure 1: Conductivity and Storage coefficient for Concrete in relation to temperature.

Specific Boundary Conditions for any potential problem:

- mixed type boundary conditions, Dirichlet and Neumann, along the boundaries.
- point sources or sinks for the simulation of dams.

- imposed flow rate or heat flow along some boundaries.
- surface elements boundary conditions for the simulation of inflow or outflow conditions from a surface, i.e. waterfall.
- addition of source terms into the diffusion equation of the potential problem.
- superposition of boundary conditions, time dependent boundary conditions based on specific functions or table of values.
- free convection and radiation boundary conditions.

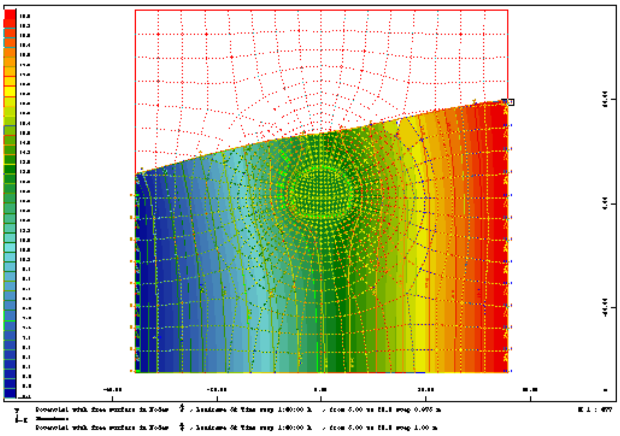


Figure 2: Potential and free surface of water during a tunnel excavation.

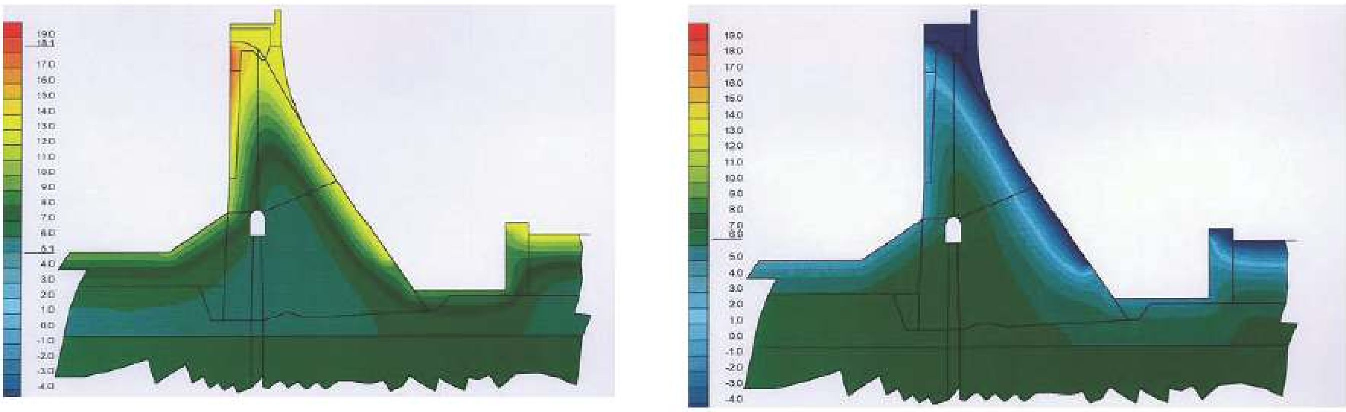


Figure 3: Temperature distribution for a gravity dam during summer and winter.

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