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ATENA v4 TECHNICAL SPECIFICATION

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FINITE ELEMENTS

- 2D isoparametric elements, quadrilateral, triangular. Axisymmetrical elements.
- 3D solid elements: tetrahedron, brick, wedge. Low- and high-order. Shells (layered). Beams (fiber).
- Truss elements for reinforcement.
- Spring supports.
- External cable elements
- Interface, gap

MATERIAL MODELS

- 2D SBETA concrete model, also for high strength and SFRC: smeared cracks, crack-band, fracture-energy-based softening, Kupfer's compressive failure, variable shear retention, strength reduction of cracked concrete.
- 3D fracture-plastic concrete model based on Menetrey-Willam law: smeared cracks, fracture-energy based softening, Compression Field Theory aggregate interlock in shear, non-associated plasticity, user defined functions, variable parameters.
- Reinforcement bi-linear and multi-linear. Reinforcement with bond.
- Von Mises plasticity for metals.
- Drucker-Prager plasticity with associated / non-associated flow rule for rock and soil.
- Bazant M4 microplane concrete.
- Reinforcement cyclic.
- Interface with Mohr-Coulomb material law.
- Isotropic elastic.
- Non-linear springs.
- Temperature dependent (Fire)
- Creep and shrinkage (Bazant, Eurocode, ACI)
- Transport of heat
- Fatigue of concrete in tension
- User-supplied material subprogram

LOADING

- Load cases: body forces, loading forces, supports, prescribed deformations, temperature, shrinkage, prestressing.
- Load steps: combination of load cases, solution methods.
- Arbitrary load history in steps, non-proportional, cyclic, dynamic.
- Construction process.

SOLUTION METHODS

- Direct and sparse solver of equations. Eigenvalue.
- Newton-Raphson and modified Newton-Raphson.
- Arc-length. Line-search.
- Tangential and elastic stiffness predictors.

GRAPHICAL USER ENVIRONMENT

- 2D GUE. Graphical user environment: pre-processing (geometrical modeling, reinforcement (bars, smeared), automatic meshing, material properties, loading and supports, solution methods, monitoring), solution (non-linear FE solution, graphical monitoring, restart), post-processing (iso-lines, iso-areas, rendering, vectors, tensors, cracks, response diagrams, cuts/sections, internal forces (M,N,T), user-defined numerical output).
- 3D GUE. Graphical user environment: pre-processing (geometrical modeling, reinforcement (bars, smeared), copy and move, automatic meshing, material properties, loading and supports, solution methods, monitoring), solution direct or sparse iterative, graphical monitoring, restart), post-processing (iso-lines, iso-areas, rendering, vectors, tensors, cracks, response diagrams, cuts/sections, user-defined numerical output).
- AtenaWin. General semi-graphical user interface for ATENA for solution and post-processing of 2D and 3D models. Requires input text files.
- GiD interface (GiD - general FE pre- and post-processor from CIMNE, Spain) with interface to ATENA.

EQUIPMENT

Minimum: PC with MS Windows XP SP2/W7/Vista SP1/2000 SP4 Rollup 1, 512 MB RAM memory (1GB for W7 and Vista) and 40 GB HDD, graphics resolution 1024x768.

Recommended: MS Windows XP, 4GB RAM memory, 500 GB hard disk, graphics card with resolution of 1280x1024 and Open GL 3D hw-acceleration, designed for CAD (e.g., nVidia FX, ATI FireGL/FirePro).