

TOCHNOG PROFESSIONAL FEA

Tochnog Professional is a Finite Element Analysis (FEA) solver developed and distributed by Tochnog Professional Company. It can be used for free, both for academic work and commercially. The source is not made publicly available however. The software specializes in geotechnical applications, but also has options for civil engineering and mechanical engineering. Input data is provided by means of an input file, containing all information that is needed for performing a calculation. Parts of the input file can be generated by external pre-processors. Output is generated by several generated output files. These can either be used in external post-processors, or the files can directly be used for interpretation of calculation results.

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Tochnog Professional FEA

Original author(s)	User:RoddemanDennis
Developer(s)	Tochnog Professional Company
Initial release	1997
Stable release	current date
Operating system	Microsoft Windows Linux
Platform	Windows/x86-64 Linux x86-64
Type	Computer-aided engineering, Finite Element Analysis
Website	tochnogprofessional.nl (http://tochnogprofessional.nl)

History

Development of the Tochnog Professional program started 1997 by Dennis Roddeman. The programming is done completely in the c++ programming language. The program is setup as a batch program, and should be started from the command line. In 2019 Dennis Roddeman started Tochnog Professional Company (<https://www.tochnogprofessional.nl>), which presently is the owner of the Tochnog Professional program. Since 2019 the program is listed on the soilmodels research site (<http://www.soilmodels.com>)^{[1][2]} with over 2000 research members both as generic purpose program and also as incremental driver. It is listed in the geotechpedia (<https://geotechpedia.com>) geotechnics programs overview site. Many peer reviewed scientific papers discuss usage of the Tochnog Professional program, see the reference list below.

Tochnog Professional functionality

- Calculation domains

- 1D, 2D, 3D, axisymmetric and spherical.

- Element types

- Linear, quadratic and cubic elements.
- Springs, beams, trusses, interfaces, boundary elements.
- Automatic distribution trusses (no-slip reinforcement bars).

- Equation types

- Material stress, groundwater, temperature calculations.
- Full coupling between these different analysis types.

- Material stresses

- Linear elasticity, elasto-plasticity, visco-plasticity^[3]
- Many built-in hypoplasticity (https://www.researchgate.net/publication/265230184_Hypoplasticity_for_beginners) laws.
- Multi laminate plasticity model.
- Cracking models.
- Mesh independent softening with non local visco plasticity.
- All parameters can depend on time and solution fields.

- Groundwater analysis

- Saturated and non-saturated.
- Consolidation analysis, fully coupled.
- Multiple phreatic levels, flux calculations, etc.
- Hydraulic safety factors (piping, lifting).

- Temperature

- Conductivity, capacity, environmental convection and radiation.

- Boundary conditions and loads

- Mesh independent boundary conditions and loads

- Time stepping types

- Static, quasi-static and dynamic.

- Phased analysis

- Excavations
- Layer depositing
- Material change of elements over time
- Boundary conditions changes, etc.

- Stability analysis

- Stability safety factors with parameter reduction (phi-c reduction or any other reduction).
- Local mesh refinement based on calculation results (automatic restart after refinements).
- Stability safety factors with classical methods.
- Stochastic distribution of all material parameters for risk analysis (Monte Carlo simulations).

- Solvers

- Shared memory systems pluralization.
- Direct and iterative equations solvers.

- Pre- and postprocessing

- Interface with external GID CIMNE (<http://www.gidhome.com>), GMSH and Paraview.
- History files and data-versus-data columns for Gnuplot, Excel etc.

Example calculations

- Constitutive Models^{[4][5][6][7][8][9][10][11][12][13][14]}
- Foundation^{[15][16]}
- Masonry^[17]
- Georeinforced soil^[18]
- Bridge^[19]
- Tank^[20]
- Tunnel^[21]
- Horizontal pile testing^[22]
- Sheet pile retaining wall^[23]
- Pile penetration^[24]
- Offshore^[25]
- Progressive failure (non local)^{[26][27][28][29][30]}
- Landslide runoff^{[31][32][33][34][35][36][37][38][39][40][41][42][43]}
- Earthquake analyses^{[44][45]}
- Text book examples^[46]
- Hypoplastic calculation centrifuge experiment^{[47][48]}
- Analysis artificial lumpy materials^[49]
- Displacement patterns during an excavation^[50]
- Undrained cavity expansion^[51]
- Shear strain amplitude by railroad traffic^[52]
- Vibrocompaction methods^[53]

Tochnog Professional Company

Tochnog Professional Company is started by and also presently owned by Dennis Roddeman and Silvia Imposimato.

Supported platforms

Platform	Operating System	Compilers Used
x86-64	<ul style="list-style-type: none">▪ Microsoft® Windows all versions▪ Linux all versions	<ul style="list-style-type: none">▪ Windows: <u>Intel C++</u>▪ Linux: <u>Gnu</u>

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2. D. Mašín (2017). "Introduction of new SoilModels project". *19th ICSMGE*. Seoul, Korea.
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External links (<http://www.tochnogprofessional.nl>)

- Official website: <http://www.tochnogprofessional.nl>
- Soil models tochnog general purpose: <https://soilmodels.com/tochnog/>
- Soil models tochnog incremental driver: <https://soilmodels.com/tochnogdriver/>
- Geotechpedia: <https://geotechpedia.com/Software/Publisher/251/Tochnog-Professional-Company>
- GID CIMNE: <https://www.gidhome.com/gid-plus/modules/modules-research/671/tochnog/>
- GMSH: gmsh.info
- Paraview: paraview.org

CAE software

Open-source	Advanced Simulation Library · Calculix · Code Saturne · deal.II · Elmer · FEniCS · FreeFem++ · Gerris · GetFEM++ · MOOSE · Open Cascade Technology · OpenFOAM · QBlade · Salome · SU2
Proprietary	Abaqus · Actran · ADINA · Altair · Ansys · Autodesk Simulation · AVL · CATIA · COMSOL Multiphysics · CST Studio Suite · DIANA · FEATool Multiphysics · Femap · Fluent · FORAN · JCMsuite · JMAG · KIVA · LS-DYNA · MSC ADAMS · Nastran · PTC Creo · RFEM · Sesam · Siemens NX · SolidWorks · StressCheck · Working Model
Cloud-based	SimScale · CONSELF · Onshape
