ZSOIL.PC (since 1985) : A Windows-Based Tool offering a unified approach to numerical simulation in soil and rock mechanics, above- and underground structures, excavations, soil-structure interaction and underground flow, including dynamics, thermal and moisture migration analysis.

**MAIN FEATURES.**

**ZSOIL MENU:** • Menu-driven Integrated Computer Environment using MS-Windows platforms (Windows 7 & 8) • Basic / advanced user configurations • Units management • Import of data from Autocad and from or to Excel.

**ZSOIL ANALYSES:** • Automatic memory release to optimize computer use, • Data checking capabilities • Axisymmetric, Plane strain, and 3D drivers • Single and 2-phase analyses, including partial saturation • Nonlinear small and large displacements • Automatic evaluation of the most complex initial state conditions, including existing constructions • Stability analysis: through C-phi reduction and stress level algorithms • Possibility to analyze safety with respect to local material properties or features like contact surfaces • Ultimate load and deformation analysis • Prestress conditions (anchors) • Simulation of Excavation & construction stages • Simulation of fill for cut and cover construction, combined with any sequence of drivers, allowing removal or addition of construction parts, loads, boundary conditions, etc • Unloading control capability in order to simulate 3D effects in 2D • Continuous safety assessment • Consolidation, volumetric and deviatoric creep and swelling (time dependent processes) • Flow, steady or transient, fully or partially saturated, with time dependent boundary conditions, rain inflow, impermeable zones, coupled or uncoupled with solid deformation • Transient thermal/or moisture migration analysis performed as preprocessing in order to define temperature time-histories to be accounted for later in the mechanical analysis • Transient dynamics: Time integration - Single phase and 2-phase dynamic soil-structure interaction module - Domain Reduction for single and two-phase fully/partially saturated media - Extraction of eigenvalues and eigenmodes • Pushover analysis for structures, including soil-structure interaction • Skyline, or sparse solvers, tested up to over 1’000 000 DOFs for symmetric stiffness matrices and 600 000 DOFs for nonsymmetric ones • Stabilized finite element formulations for 2-phase media without time-step restrictions. Easy-to-use integrated 2D/3D • ZSOIL PRE-PROCESSOR • Interactive quasi-automatic mesh generation and profile optimizer for the finite-element discretization allowing to generate a mesh of up to over 1’000’000 DOFs in minutes • Unified menu system for 2D & 3D, under C++ • Macro-modeling tools allowing for a speed-up factor of up to 10 in complex 3D mesh generations • 2D/3D Meshing tools • Automatic element split • Data super-elements • Macros • Autocad & Excel compatibility • Undo • Overlaid meshes capability • Units management. ZSOIL POST-PROCESSOR • Windows compatible fully integrated 2D/3D post-processor with many capabilities like, improved stress recoveries, cross-sections, time-histories completing the existing color plots, isolines, units management, etc... • Excel compatibility • Recording & playing macros • Improved selection options.
SOIL IDEALIZATION. Constitutive Models: ZSOIL-PC uses the most robust numerical algorithms to simulate nonlinear time-dependent soil behavior, according to the Tresca, Mohr-Coulomb w. dilatancy cut-off, Rankine, Drucker-Prager-Cap, Cam-clay, Hardening soil small strain and densification models for soil, multi-lamine for layered media and schists, Hoek-Brown models for rock, Menétry-William (with softening) for concrete and Biot-type models for the consolidation and two-phase problems; user defined models capability for continuum, user defined fiber model for beams. The program can efficiently simulate any types of load and soil stress conditions, for example: • Gravity fields and initial stress conditions • Water table and water pressures under steady state or transient conditions, totally or partially saturated, including time dependent boundary conditions • Drained and undrained soil conditions • Explicit definition of excavation/construction sequences • Imposed displacement fields • Concentrated and distributed loads applied at the boundaries of the soil medium • Unloading control for convergence analysis in tunnels • infinite or semi-infinite media • User models- Users can introduce their own constitutive model.

Element library - The nonlinear finite element scheme incorporated in Z_SOIL-PC uses 2D, 3D and axi-symmetric elements which optimally represent the nonlinear constitutive soil models and overcome locking phenomena often associated with incompressible and dilatant behaviour and also spurious pressure oscillations. Structural elements complete the element library, including linear and nonlinear beams, with hinges, flexibility based nonlinear beams (allowing 1 element /beam), shells (including reinforced concrete), with possible hinges, membrane, geotextile, reinforcement and cable behaviours. Finally, infinite media and a new frictional contact mortar and node to segment interface elements, permeable or impermeable, are available for single or two-phase media. These elements offer the flexibility to model any configuration of soil profile.

DOCUMENTATION AND SUPPORT: Practicing geotechnical engineers with little formal experience in numerical modeling or plasticity theory can learn how to use ZSOIL-PC in a very short time using the “user-friendly” automated environment of the program, the Getting started manual for beginners. In addition, the user will find: A user interface with basic/advanced entry level • A fully interactive online help and manual with indexed access • A User's Manual which includes information on program execution, data entry screens and extensive documentation of the analysis options • In-depth tutorials on how to use the program and • A theoretical section which contains unique details on the algorithms • An extensive list of benchmark problems. • A selection of representative case studies.

NEW IN RECENT VERSIONS. DESIGN: • Modeling large foundation rafts in 3D. - piles are modeled as beam elements discretized independently on surrounding continuum - Mohr-Coulomb friction law is applied - additional pile foot interface is created to model pull-out effect - redesigning piles is very fast- option fully automatic working both at the macro-modeling and finite element levels • Constitutive models: Hardening Soil/Hardening Soil-small strain model for modeling deep excavations and soil-structure interaction problems - small-strain stiffness of soils is reproduced by HS-small model, - excessive heaving of the bottom of excavation is eliminated, - nice predictions of the influence of excavations on neighboring structures in urban areas • Parametric studies enabling variation of a selected set of material properties • Automatic inheriting of contact strength properties from adjacent continuum • Automatic mapping of complex geological layers defined through boreholes on 3D meshes • Orthotropic elastic model for shells • Wood-Armer stress resultants for plates/shells • Nails with adhesive interfaces - 2D/3D analysis of soils strengthened by nails is supported - nails, treated as beam elements embedded in continuum, may be supplemented by adhesive interfaces following the philosophy used for piles - the ultimate shear stress set up for continuum materials can be inherited by nails automatically • Transient dynamics with: - Single phase and 2-phase dynamic soil-structure interaction module - Domain Reduction for single and two-phase fully/partially saturated media - Signal processing toolbox including Butterworth filtering and baseline correction - Nonlinear soil models: HS small strain for hard soils and Densification model for loose deposits (liquefaction phenomena) - Extraction of eigenvalues and eigenmodes - Directional filtering of added masses in structural dynamics • Compliant base model • Linear signal deconvolution • Constitutive models: Highly-interactive toolbox for automatic estimating Hardening Soil small strain model parameters, including a large number of well-documented correlations for estimating small stiffness characteristics (Go, Vs) based on soil type and field data derived from SPT, CPT, DMT, PMT • Structures: • Nonlinear (uncoupled) hinges for beams and shells • Thermal loads on beams (no necessity for heat analysis in simple cases) • Distributed loads on underground structures (without soil-structure interaction) • Improved contact interface definition on structural elements • Data preparation • Improved automatic meshing (quads only) • Displaying shell thickness • New postprocessing options including : - Result envelopes for continuum/shell/contact - Result envelopes for selected set of instances for beam/truss elements - Elements plot as color contour on element faces or in cross section for selected set of time instances • Maps, diagrams for user results • Export of envelopes to external text files • Manuals: extension of the Getting started manual for beginners.

NEW FEATURES in Version 2014: • A new main menu user interface • New capabilities to import data from other projects • A new parameter definition assistant for soil models based on laboratory tests • A new (traditional) version of Hoek-Brown model • New drivers and control options with optimal nonlinear solver search and automatic time step reduction • Introduction of Evolution functions to manage temperature dependent parameters (for fire problems) • New user interfaces for layered beams & axisym. shell models • User programmed output capability for continuum, beams, & shells, in C++.

ZSOIL SERVICES: • HOTLINE : zsoil@zace.com (for customers only) • Short courses: “à la carte”, every month • User meeting: every year, last week of August • Custom developments: Ask for it, you may get it • Assistance: consulting and meta-consulting services • Free student version.

Hardware/Software Requirements • Processor: Intel Core 2 Duo or higher (Intel Xeon processors recommended) • System 64 bit: Windows Vista Business 64 bit, 7 Ultimate, 8 • RAM : 4GB MB (2D) , min. 4GB (3D), 32GB recommended • Hard-disk space : 100 GB • Graphical resolution: higher than 1280 x 1024 (1024 x 768 supported).

*Coming up EVENTS*: Aug. 26-27.2015. Introduction to ZSOIL-PC , short courses, at EPFL, Lausanne, Switzerland. • Aug.28.2015 30 YEARS ZSOIL-PC, seminar & ZSOIL user meeting “NUMERICS IN GEOTECHNICS AND STRUCTURES”, at EPFL, Lausanne, Switzerland.

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