With lots of new features, we are proud to present DIANA 9.5 to both our new users and existing customers. At the top of our list of enhancements is our new and user friendly MeshEdit.

Designed in-house with direct input from the DIANA developers, and based upon the requirements of DIANA users, this initial version of the software is packed with functionality. In future versions we will be introducing more features than will allow DIANA users to streamline their analyses even more tools at their fingertips.

New MeshEditor

Functionality:

- Import of .dat, .fxd and .nas files
- Viewing of mesh
- Interactive creation of GROUPS
- Editing materials, geometries and data
- Editing supports and nodal loads
- Material classes
- Viewing of other loads
- Analysis control settings
- Graphical review of phased analysis control
- Running analysis
- Contour plots of results, deformed meshes and vector plots
- Scripting - logging and replay (Python)

For a demonstration of the new DIANA MeshEdit see our YouTube site.
The New DIANA MeshEditor

History

The original DIANA user interface was iDIANA. Utilising this product, the user was able to access all of the functionality of DIANA - while in the process of being replaced by the new MeshEdit, iDIANA is still available.

Seven years ago we sought to bring our user interface up to date with the introduction of the MIDAS FX+ for DIANA pre-/post-processor. This gave our users a modern, windows based, environment within which they could input their model and process the model results. However, users still needed to use the in-built MeshEdit to set up and run the analysis.

For some time, we have felt the need to improve upon this to provide our users with a streamlined process from the setting up of geometry to processing of results.

Where we are now

In order to accomplish our goal TNO DIANA BV took on an experienced team of graphical user interface developers who have worked alongside the DIANA developers to create the new MeshEdit. The MeshEdit is still in its infancy, but already we feel it’s worth distributing to both our existing and new customers.

As mentioned above, the “all new” MeshEdit has been designed with input from the DIANA developer team, but not only them - we have listened to our users and implemented many of the requested features highlighted by them.

With the release of DIANA 9.5, the old MeshEdit is replaced by this new windows based system.
Users can automatically import their model from FX+ for DIANA (or from iDIANA). Once imported, the new interface can be used to set up:

- Mesh group definition
- Support and loading definition
- Materials definition
- Analysis control definition
- Running analysis
- Post processing

**The Future**

Whilst our users are getting used to the look and feel of the new MeshEdit, we will continue implementing new features for each new version. Ultimately, users will be able to set up their Geometry, carry out complex meshing, add materials, boundary conditions and loads, carry out sophisticated analyses and view/analyse results with a variety of output options.
Material Models

• NEW Material input functionality (in the new MeshEdit GUI) with reference to international design codes for concrete and steel
• NEW Tresca and Von Mises plasticity, total strain-stiffness diagrams
• EXTENDED Kinematic hardening for Von Mises and Drucker-Prager plasticity
• NEW Bond slip relation as proposed by Shima et al.
• EXTENDED Orthotropic linear stiffness and nonlinear elastic diagrams for plane interface elements
• NEW Dodd-Restrepo Plasticity - for cyclic behaviour of steel reinforcements
• NEW User supplied subroutines for uniaxial springs
• EXTENDED JSCE tension softening and stiffening
• NEW Total Strain Crack models:
  - shear-retention models
  - damage based shear retention
  - aggregate size based shear retention
• NEW Total Strain Crack model - Maekawa compression curve
• NEW Modified Takeda model for use in combination with beam elements
• NEW Eurocode fire load curves as set out by Eurocodes 2 and 4 for compression in concrete and for steel reinforcements
• NEW Modified two surface model - a plasticity model with two yield surfaces in which the hardening of the concrete is dependant on the distance of the stress point from both yield surfaces
• NEW Modified UBC sand model - a new liquefaction model developed by the University of British Columbia which has been further developed by TNO DIANA so that it is suitable for implicit integration schemes and is now suitable for 3D implementation
• UPDATED modified MMC model with engineering input, which has been extended with a tension cut-off and dilatancy cut-off
• UPDATED validation of COMBIF model for masonry, this combines the characteristics of cracking, shearing and crushing
• UPDATED Rankine Hill orthotropic plasticity, now also available for curved shell elements so that it can now be used in 3D models

Element Types

• NEW T18FSH - 3-node analytical integrated flat shell element

The T18FSH element is a three-node triangular analytically integrated flat shell element. The plate bending is based on Kirchhoff theory and based on the formulation by Allman. The membrane behaviour is also based on Allman’s formulation. The element is particular suitable for post-buckling and nonlinear vibration analysis based on perturbation theory. This enhancement is based on Tiso’s work. Additionally, the element can consider geometric nonlinear behaviour.
Analysis Procedures

New Liquefaction model in DIANA can be used for both 2D and 3D models covering static and transient analyses.

Development of pore-pressure in conjunction with plastic strain enables to simulate lateral spreading effect on the underground and embedded structures.

- **UPDATED** Strength reduction analysis module “REDUCT”.

- **UPDATED** Phased analysis. Support sets/tying sets can now be activated as part of the phased analysis; and material properties can be redefined for selected elements throughout the phased analysis; and in excavation analyses, the internal forces of the removed elements can be retained in following phases

- **NEW** Modal pushover analysis

- **NEW** Reduced order nonlinear free vibration analysis *VIBRAT*, allows eigenvalue analysis considering geometrical nonlinear aspects

- **UPDATED** Automatic determination of Rayleigh damping parameters in an Eigenvalue analysis

- **NEW** Multiple calculation of Rayleigh parameters

- **NEW** Output results for Janssen material model (tunnel lining, concrete face in CFRD dams and etc)

- **NEW** Output of dynamic pressures in HFTD

- **EXTENDED** Nodal result based stop criteria

- **NEW** Output of shear capacity and hydrostatic pressure capacity

- **NEW** Definition of complex loads

- **NEW** Shear stress in reinforcement mother element connection

- **UPDATED** Minimum and maximum results values for steady-state heat flow and groundwater flow analyses

- **UPDATED** USS definition and dynamically linked to libraries

- **NEW** Automatic tying

- **UPDATED** Euler stability analysis
Design Functions

- **NEW** Composed surfaces for unstructured mesh
- **EXTENDED** Predefined material models in combination with stiffness adaptation analysis
- **UPDATED** Output to UCCOV and USCHR for *DESIGN

Geotechnical Analysis

- **EXTENDED** Weight and equivalent acceleration load defined at model level
- **EXTENDED** Boundary constraints can be defined as pore-pressure or total head in ground-water flow or mixture analyses
- **NEW** Output of effective and total stresses in nonlinear analyses
- **EXTENDED** Restructure of mixture/consolidation analysis such that pore pressure has the same meaning as in non-mixture analysis
- **NEW** Unsaturated groundwater flow analysis
- **EXTENDED** Foundation piles can be modelled as bond-slip reinforcements
- **NEW** Automatic determination of pile properties based on developed confined stresses in soil layers

Licensing

With the release of DIANA 9.5 we are introducing a new electronic licensing system where, for some clients, the use of a hardware key will no longer be necessary.

Services

**Support & training**

Successful finite element modelling requires sound understanding of the background theory with good engineering judgment. We at TNO DIANA, together with our partners, are dedicated to providing the highest level of service for DIANA:

- Personalised hotline and email support by highly qualified staff
- Customised training solutions
- Regular training courses
- Extensive technical and theoretical manuals
- Online training sessions

**Analysis consultancy**

TNO DIANA can carry out analysis consultancy projects on behalf of their clients. This service includes analysis with DIANA and the interpretation of results

**Software services**

TNO DIANA Consultants and software development team can provide customised solutions for your engineering problems:

- Specialised software with dedicated GUI
- New modelling capabilities development and implementation
- Integration with customer software