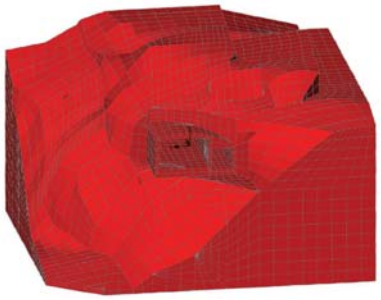
LUSAS
Civil & Structural




Geotechnical and soil-structure interaction analysis software

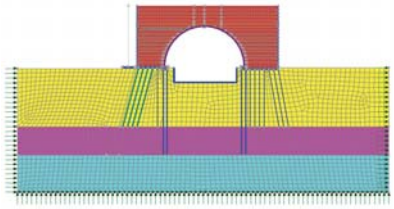
Geotechnical modelling

LUSAS Civil & Structural analysis software provides a range of soils-specific and general structural engineering analysis tools to enable finite element modelling of both ground and structure in a single model. Multiple analyses can be solved within each model, and state-of-the-art linear and quadratic element libraries; advanced material models; and linear and nonlinear joint models allow a range of soil-structure engineering problems to be solved.



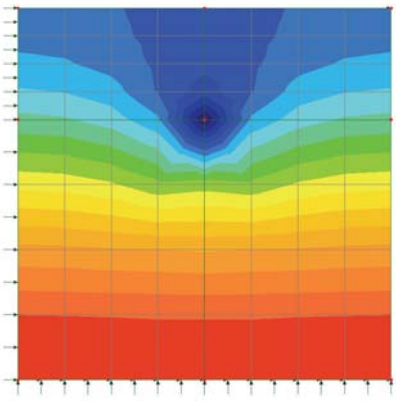
Modelling

LUSAS models are created using feature-based geometry methods (points, lines, surfaces and volumes) and built-in associativity, a key feature of the LUSAS Modeller, ensures that if the model geometry is amended, all assigned loadings, supports, mesh and other attributes are automatically updated to suit.



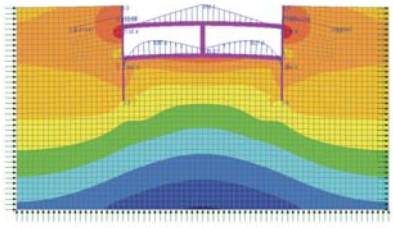
■ CAD import / export facilities permit importing of point and line data from DXF files; points, lines, surfaces and volumes via IGES/STEP interafaces; and triangulated surface data through STL. CAD-style drawing tools provide an array of modelling utilities such as copy, rotate, scale, transform, extrude etc.

■ For 2D modelling splines can be created from terrain points data and swept to create strata. Surfaces can be defined from bounding points and lines, and swept to define a soil mass. Structural and soil components can be grouped for modelling purposes. For 3D modelling, planar or curved surfaces can be swept for multiple volume creation, and intersection and subtraction commands provide the means to slice volumes or create voids.



■ Automatic 2D meshing (using quadrilateral/triangular elements) and 3D meshing (using tetrahedral/pentahedral/hexahedral elements) speeds up the modelling process. Various mesh refinement methods are provided.

■ Constitutive soils models include Tresca, Von Mises, Druker Prager, Mohr Coulomb, and Modified Cam Clay. Two-phase material properties can be added to selected materials to permit modelling the deformation of undrained/fully saturated and fully-drained/unsaturated porous media, and slow consolidation process. Draining and filling curves can also be specified for partially drained materials.

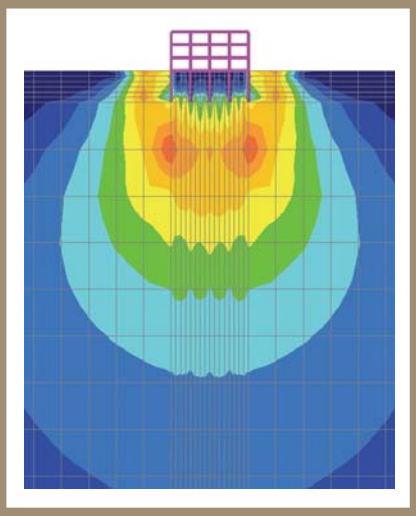


■ Nonlinear springs model active/passive soil joints. A tri-linear earth joint wizard simplifies joint material definitions. Interface meshes permit joining of the soil / structure. Gain / loss of contact, and skin friction can be considered.

Software features and capabilities described in this brochure summarize those of the LUSAS Civil & Structural product range. Separate details list the capabilities of each particular product.

Typical Applications

LUSAS software is used in all areas of civil and structural engineering for linear, nonlinear, seismic, blast, buckling, impact and thermal/field analysis. It can be used on all types of structures from simple slabs, buildings, towers and tanks through to heavy civil engineering structures such as dams, docks and tunnels. Geotechnical and Soil structure interaction capabilities include:



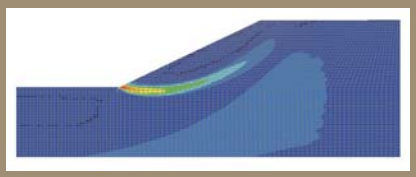
■ Construction sequence modelling - involving excavation / construction with insertion and removal of temporary members used for propping and jacking etc.

■ Embankment /slope stability assessments and stability checks on adjacent structures due to temporary excavation.

■ Backfilling of excavations and cut and cover tunnel structures.

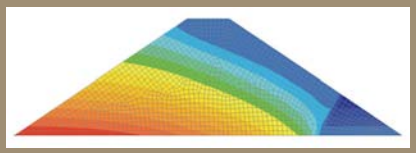
■ Settlement and consolidation including pore water pressure modelling.

■ Dewatering and seepage modelling of partially saturated fluid flow through porous media, such as seepage of water through an earth dam, where the position of the phreatic surface is of interest.



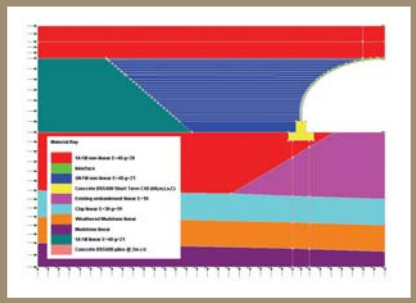
■ Modal and time history dynamics involving material damping, nonlinear behaviour, soil plasticity, boundary behaviour and springs/dampers.

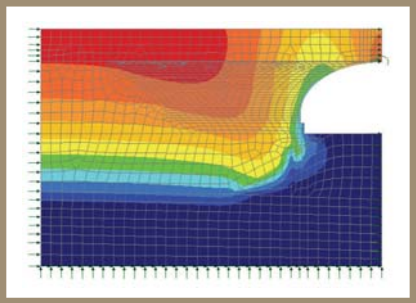
■ Soil-structure interaction analysis including vibration analysis from pile driving impact assessments on nearby buildings and response of buildings to emitted vibrations from rail tunnels.

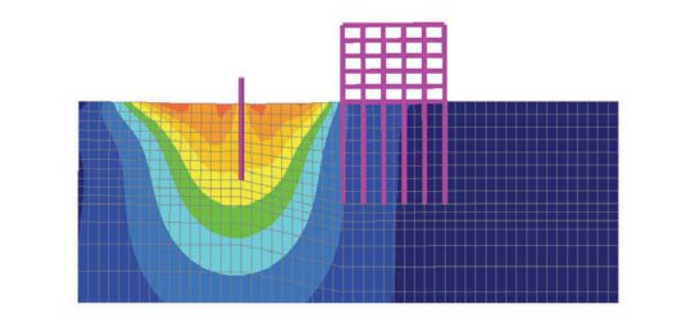


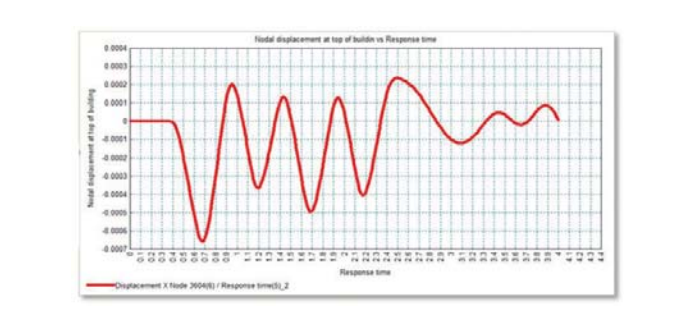
■ Lateral displacement analysis of piles and pile groups

■ Integral bridges









Results and Analysis Options

Results

■ Results can be generated in global or local directions, in element directions, or at any specified orientation, combined and enveloped and viewed on separate layers for diagram, contour, vector and discrete value data. Results can be plotted on multiple slices cut through 3D solid models on arbitrary planes.

■ Graphing of data includes the ability to plot results for a line section through a 2D surface model, or a slice through a 3D model.

■ Animations of results - particularly useful for animating construction/ excavation stages and viewing of the effect of seismic events - are supported.

■ Selected modelling, loadcase and results data can output in a report format for quality assurance, model checking, and results listing purposes.

■ Results can be selectively output to spreadsheet applications for additional external calculation and graphing uses.

Analysis options

■ The Nonlinear analysis option is used to solve problems having large deformations, material nonlinearity and complex boundary conditions. When combined with the LUSAS Dynamic and Thermal / Field software options problems in which the effects of time and temperature are important can be solved.

■ The LUSAS Dynamics analysis option provides the means to analyse the propagation of waves through the soil, as caused by seismic loading or by construction activities, in order to assess their influence on structures.

■ The LUSAS Thermal / Field analysis option contains extensive facilities for both simple and advanced steady state, and transient thermal / field analyses.

■ The LUSAS IMDPlus analysis option extends the Interactive Modal Dynamics (IMD) techniques which model a single loading event in a single direction, to analyze multiple loading events such as required for seismic response analysis of 2D and 3D structures subjected to acceleration time histories.

in summary

Use for:

■ Soil-structure interaction analysis

■ Excavation and construction

■ Embankment /slope stability

■ Construction sequence

■ Settlement and consolidation

■ Dewatering and seepage analysis

■ Modal and time-history dynamics

■ Pile and pile group analysis

■ Retaining walls

■ Tunnelling / cut and cover tunnels

■ Dams, docks, heavy engineering

■ LNG tank, silo and turbine bases

■ Integral bridges

...and more

LUSAS

Issue 1.

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