PLE-micro-CAD version 3.09.08

The new version 3.09.08 of PLE-micro-CAD contains a number of modifications and extensions of functionality resulting in the availability of new applications. The modified/new modules are:

- B-module   : the Offshore Pipeline Module: in this new module the soil mechanical parameters are interpolated between (near) zero (soil surface value) and the specified values in DF3.2 dependent on the calculated imprint of the soil (read: seabed) surface. This option may be used in pipelay calculations offshore to improve iteration stability.
- J-module   : the Articulated Pipeline Module: the behaviour of a joint at the maximum allowable rotation has been improved. The rotation is fixed at its maximum rotation and the joint becomes stiff in flexure.
- M-module   : the Non-linear Material Behaviour Module: the total radial displacements of the points of the pipe cross-section have been added to the result tables.
- S-module   : the Stress Module: the total vertical displacements of the pipeline after the extra loadings in Design Function 6.1 (e.g. traffic) have been added to the result tables. Up till now only additional vertical displacements were reported.
  Moreover the total radial displacements of the points of the pipe cross-section have been added to the result tables.
- U-module   : the Flexible Module: the stiffness of the soil counteracting the ovalisation of a cross-section is taken into account resulting in lower ovalisation and stresses, especially of importance for buried pressureless flexible plastic pipes and/or thinwalled steel pipes.
- Y-module   : the Branching and Tees Module: there is a new description how to model branches and a update of the description how to model Tees. Especially of importance for first time users and available on request.
- Z-module   : the Upheaval Buckling Module: in this new module the soil mechanical parameters are adapted after each iteration to meet the values valid at the newly calculated depth location. This option is useful for so-called upheaval buckling calculations where the pipeline may move to the ground level due to high axial compressive forces caused by high temperatures.

The Flexible module is available now for distribution.
The existing modules of version 3.09.08 have been modified / extended as follows.

SN012.1   *Function 3.3:   Compose model boundary conditions*

- The description of the input table ENDPTS has been extended in order to clarify the required input in case of a pipeline model with one or more branches, especially for first time users.

SN012.2   *Function 4.2:   Compose pipeline loadings*

- If the total settlements in nodes of a connection point are different, a (new) warning is given. In most cases this is the result of erroneous input specifications.

SN012.3   *Function 5:   Determine pipeline behaviour*

- The behaviour of joints near the maximum allowable rotation has been improved. The maximum rotation is fixed at the allowable value and reported in result table DISPJNT. The joints in question have been made stiff in flexure and will bear a bending moment.

- The Advanced Screen of Function 5 contains a button for SOIL MODEL options. STANDARD is default. Apart from that there are the options PIPE ON SOIL and PIPE IN SAND. The first one is meant for pipelay calculations when the pipeline touches the seabed. Numerically this is an instable situation due to the relatively firm seabed. The iteration process is improved by changing after each iteration the soil stiffness dependent on the calculated imprint of the pipe in the soil.
- The PIPE IN SAND option is used in so-called upheaval buckling calculations. A hot pipeline following at a certain depth the uneven soil surface offshore or onland tends to move to the soil surface at the 'upper bends' due to the high compressive axial force. If the lateral soil resistance – the passive vertical soil reaction – is too weak to hold the pipeline, the latter will move upward and possibly break out of the soil. To simulate this process as well as possible the soil mechanical properties are adapted to the values valid for the calculated depth after each iteration.
  This option has proven to be able to approach the deformed shape of the pipeline in practical cases very well. Module N is required when using this option.
- The Advanced Screen of Function 5 contains a button for switching the FLEXIBLE option ON or OFF (= default). If ON, horizontal soil support springs are applied at the points of the cross-section that move outward. To the soil springs the value of KLH or KLS without uncertainty factors is assigned whichever is the smallest one. The soil resistance is maximised at 50 % of the smallest bearing capacity in accordance with NEN 3650. In case of pressureless thinwalled steel pipe or pressureless plastic pipe the resulting ovalisation may be reduced by factors.
  Modules K, N, Q, (R and S) are required when using the FLEXIBLE option.

SN012.4   *Function 6.1:   Compose cross-section data model*

- The total vertical pipeline displacements due to all loads including traffic loads have been added to result table ADDCROS. Up till now only the additional vertical displacements due to the traffic load were reported.
- If FLEXIBLE is ON, the horizontal soil support springs are applied.

SN012.5   *Function 6.2:   Perform cross-section calculations*

- If   FLEXIBLE is ON, the bilinear horizontal soil support springs are taken into account. The ultimate displacements for the linear branch of the springs (at 50% of the bearing capacity) and the actual (max.) value of the springs are reported in result tables RDPLMAX and RDISPLC.
- The total radial displacements of the cross-section are calculated and reported in result tables RDPLMAX and RDISPLC as well, whether FLEXIBLE is ON or OFF.
  The strain due to the hoop stress is taken into account when calculating the total radial displacements of the cross-section.

SN012.6   *Function 6.5:   Perform cross-section calculations (material non-linear analysis)*

- If   FLEXIBLE is ON, the bilinear horizontal soil support springs are taken into account. The ultimate displacements for the linear branch of the springs (at 50% of the bearing capacity) and the actual (max.) value of the springs are reported in result tables RLDPLMX and RLDSPLC.
- The total radial displacements of the cross-section are calculated and reported in result tables RLDPLMX and RLDSPLC as well, whether FLEXIBLE is ON or OFF.
- The strain due to the hoop stress is taken into account when calculating the total radial displacements of the cross-section.

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