DESIGN LEVELS FOR OFFSHORE STRUCTURES

State-of-the-Art and Instantaneous Pore-Pressure Model

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system. It seems (see Figs. 4.24 and 4.25) that the later has much stronger influence on the results quality. The preparation of all elements [Eqs. (4.26.1a) to (4.26.16)] from the coefficient matrix D in the analytical solution requires much more mathematical operations with relatively small and large values before the equations system is solved. This complicated and superfluous procedure is omitted in the finite-element solution where the elements of coefficient matrix [Eqs. (4.35a) to (4.35m)] are taken directly from the constant coefficients of the three coupled linear equations [Eqs. (4.34a) to (4.34c)] multiplied only by proper values obtained from the element matrices (see Figs. 4.28(a) and 4.28(b)].

4.5.8 2-D finite-element model

The above presented one-dimensional finite element solution for the wave-induced pore pressure and soil matrix displacements is thought as a very convenient tool in solving the problem of instantaneous pore-pressure. In order to make computations in terms of the pore-pressure amplitude and phase-lag, the 1-D finite-element model does not require any time-approximation in the solution procedure. It means that the coupled equations system is solved only once – this bring an enormous time-benefits comparing to the 2-D finite-element model where a certain model-time (required to assure the stability of computed results) is mainly divided into many smaller time-steps. The ability of the 1-D finite-element model is however restricted to the harmonic sinusoidal wave and no structure existence on/in the seabed sediments.

In some approximations of geotechnical problems, having either linear or non-linear character, enlarged to a two-dimensional solution and for any type of loading history, it seems to be necessary to use 2-D modelling. An example of the 2-D finite-element model for the instantaneous pore-pressure response was given by Magda (1992(b)).

References


Magda, W. (1990(d)). On one-dimensional model of pore pressure generation in a highly saturated sandbed due to cyclic loading acting on a sand surface. Part II: Laboratory tests and comparison with theoretical approach. *Internal Report No. 5, SFB-205 ‘Küsteningenieurwesen’, TP A13*, University of Hannover, pp. 1-62.


