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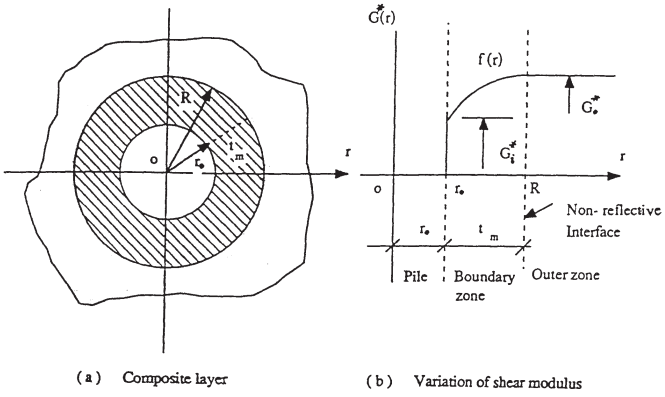
DynaN v3.0 (Improved Novak's Method with Non-Reflective Boundary)

Dynamic Analysis of Shallow and Deep Foundations

GENERAL DESCRIPTION

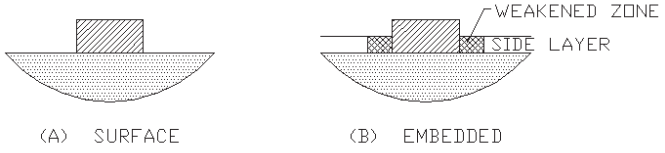
A powerful computer program should be founded on advanced theory and be verified by tests and practice. The DYNAN program follows these guidelines. DYNAN is based on the improved Novak's method where a non-reflective boundary is formed between the near field and the far field to account for the mass of soil in the boundary. The program yields the dynamic response of both shallow and deep foundations under harmonic, transient, and random loadings. Such loadings can be produced by rotating or reciprocating machines, earthquake, wind, blast, sea waves, and other sources.

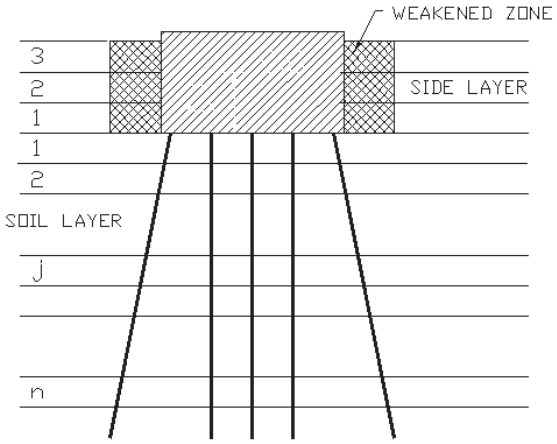


Boundary zone with non-reflective interface

The foundations (or caps on piles) are assumed to be rigid, and all six degrees of freedom are considered as coupled. The foundation stiffness and damping constants are also returned for possible use in soil-structure interaction analysis.

The stiffness of the supporting soil along with damping constants needed for the analysis and evaluated in the program for surface foundations, embedded foundations, and pile foundations. Soil layering, a possible weakened zone (see sketch) around a foundation, and pile-soil-pile interaction are all taken into account.



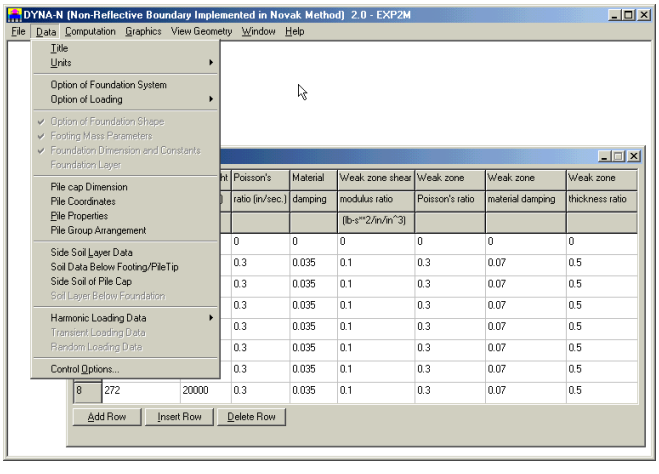


Sketch of modeled pile foundation

A RATIONAL METHOD FOR SOLVING SOIL-STRUCTURE INTERACTION

The computational method has been applied to important engineering practice (Han, 1987, and Han, et al, 1999). To investigate soil-structure interaction, a series of dynamic experiments were performed on full-scale mat foundations (Han, 1989) and on full-scale piles (Han and Novak, 1989, 1992). The elastic wave energy from foundation vibration was dissipated in three dimensions as radiation damping. The soil is not a perfect elastic medium as assumed in the theory and the experiments showed that damping is overestimated in the computation. For practical purposes, the damping is reduced in DYNAN based on experimental results.

DYNAN can be used for the dynamic analysis under transient and random loading in the time domain. It also can be used for harmonic loading in the frequency domain. By means of a substructure method, the dynamic response of superstructure is calculated using a finite element program, such as SAP2000, and the stiffness and damping of foundation are generated using the DYNAN program.



Sample input screens for DynaN

DynaN v3.0

Dynamic Analysis of Shallow and Deep Foundations

LIST OF FEATURES

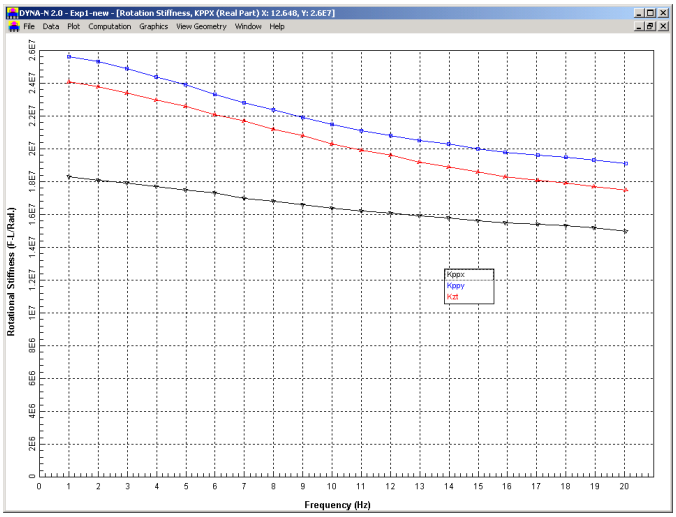
- The program employed well-established analytical solutions for soil-structure interaction under dynamic loading condition.
- The program can analyze four types of foundations: (1) footing on homogeneous half-space (half-space option); (2) footing on homogeneous layer (stratum option); (3)footing embedded in layered medium (multilayer option); and (4) deep foundation (pile option).
- The program was developed based on the improved Novak's method and a non-reflective boundary is formed between the near field and the far field to account for the mass of soil in the boundary zone.
- For practical design purposes, the foundations (or caps on piles) are assumed to be rigid, and all six degrees of freedom are considered as coupled.
- The group effect of piles is accounted for by using the method of interaction factors in the DynaN program.
- In DynaN, the harmonic excitation can be of two types: constant amplitude excitation, and frequency dependent (quadratic excitation).
- The program accepts either S.I. units or English units.
- DynaN can be used for the dynamic analysis under transient and random loading in the time domain (see Han and Cathro, 1997). It also can be used for harmonic loading in the frequency domain.
- The program generates the output data for each frequency of harmonic loads on the foundation.
- The graphics menu allows quick observations of results contained in the output file.
- The files of input data and output data are text based and may be directly accessed from within the DynaN program, employing the user's preferred text editor or word processor.

SOFTWARE SUPPORT

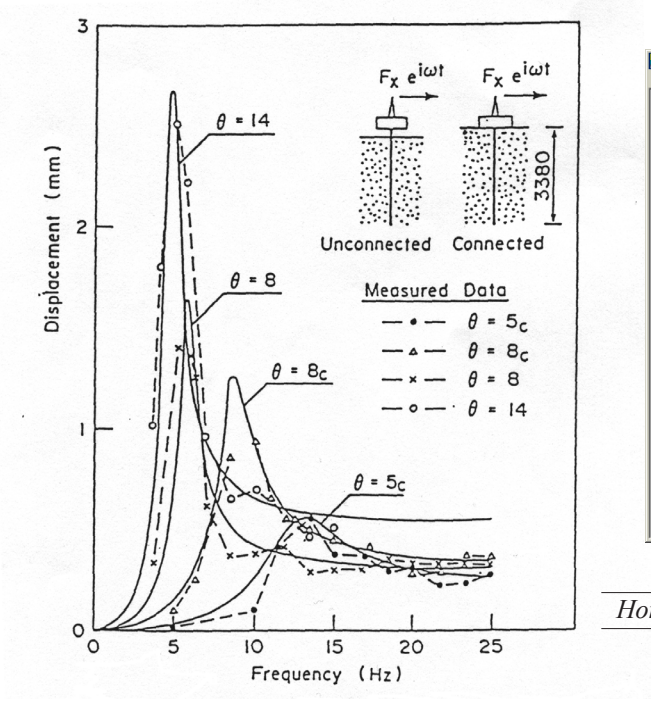
All users are strongly supported in technical aspects related to the proper usage of our computer software. The initial purchase of the program includes the cost of software support that is provided by competent engineers and software programmers. However, support is only provided to users of the latest version of our programs. Upgrade costs cover new program enhancements as well as renewed technical support. Software is usually upgraded in cycles of 12 to 18 months.

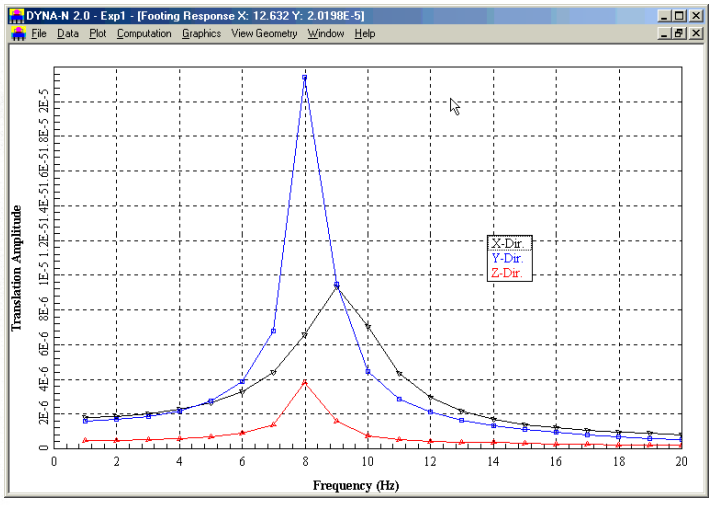
COMPANY BACKGROUND

ENSOFT, INC. uses modern computational techniques and broad experience to obtain fast and reliable solutions to engineering problems. Thousands of private companies, government agencies, and universities from the United States and 60 other countries have selected software developed by ENSOFT, INC. for their various engineering projects.



Sample output plots for DynaN





Horizontal response curves