PLPAK NEWS

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DEVELOPMENT
The PLPAK software is in constant development to meet the needs of industrial and research purposes. Updates to the software will be posted monthly.

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PUBLISHED PAPERS
Based on the PLPAK

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A PROBABILISTIC BOUNDARY ELEMENT METHOD APPLIED TO PILE DISLOCATION PROBLEM

Samer Sabry F. Mehanny, Sameh S. F. Mehanny, Youssef F. Rashed

Abstract

In this paper a probabilistic approach is presented where the boundary element method is efficiently used to study the effect of a random shift of a given pile within a particular pile cap from its original position – the so-called pile dislocation problem – on selected output design parameters such as pile loads and bending moments in the pile cap. A new circular internal element is developed to simulate the true geometric modelling of piles. The boundary element method for the shear-deformable (thick) plate theory is employed to analyze the pile cap. The plate-pile interaction forces are considered to have constant variation over the circular pile domain. The probabilistic approach presented herein incorporates a Monte Carlo simulation technique for generating random shifts in the original position of a given pre-selected pile. The procedure has been applied to some exemplar pile caps with given piles layouts typically adopted in bridges construction. The results demonstrate that the random dislocation of piles within practical ranges/values as customarily encountered for example in pile caps pertinent to bridge applications will cause limited variations in the output design parameters investigated herein and mentioned above. In other words, it has been illustrated that the resulting dispersion in the output values due to random dislocation of piles is less than the possible intrinsic dispersion that may be practically triggered in the pile locations due to common construction inaccuracies and/or unanticipated problems during pile driving process. The study further emphasizes the efficiency and reliability of the Boundary Elements Method adopted herein for such application.


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Engineering Structures

A probabilistic boundary element method applied to the pile dislocation problem

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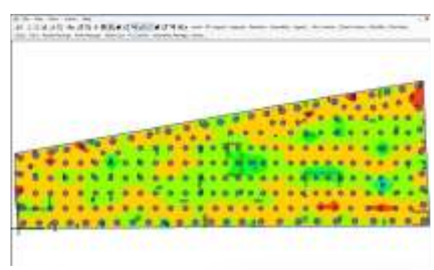
PRACTICAL APPLICATIONS GALLERY

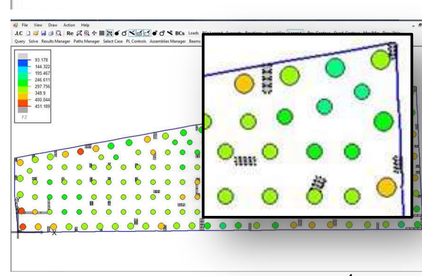
Intense piled raft analysis

Benefits of piled raft analysis u sing the PLPAK:

~ Piles could be placed at any plate of the model within the raft and with their real geometry.
~ No internal meshing adjustment is required.
~ Model generated in a matter of seconds.
~ Collaborative workspace environment; multiple imports by many users for the same model.
~ Simple export of results.

Basically, what takes the FEM days to model, is done in mere minutes with the PLPAK.





Q&A

Most asked questions? Here are the answers:

What is the PLPAK?

PLPAK (Plate analysis package) is the newest software to use the renowned boundary element method in analyzing structures. It compromises of several tools that function together in providing competing analysis results, not approachable by FEM software. Tools developed into the PLPAK include: PTPAK (post-tension analysis), EHSPAK (elastic half-space analysis), LTPAK (lateral analysis), and PLDesign (reinforced concrete structure design).

How is the PLPAK better than other similar software?

The boundary element method (BEM) that the software is based on has unique capabilities that the finite element method (FEM) doesn't. The results achieved by the BEM are more precise and faster. In BEM, the discretization is restricted only to the model's boundary, eradicating any hefty procedures for meshing inside the domain.

Structural members in the PLPAK are entered with their exact dimensions (geometry) e.g. columns and beams are no longer entered as nodes or lines, but represented with their actual proportions thus no peaking occurs on slab region contour results. The PLPAK has also been verified with several other analytical and reliable numerical methods, as well as proving to be steadfast and much quicker at solving irregular large practical models. It also acts as a fast check for FEM results. More details are accessible through the website.

How do I get a copy/ license of the PLPAK?

We have offered 50% discount to all academic staff for research or teaching purposes. Student licenses have been reduced to $990. Prices for a Basic license or a combination of packages are possible through the "Purchase" page on our website: http://be4e.com/site/node/11. A demo version is now released for you to explore PLPAK's possibilities.

In need of more questions answered?

We are always on the alert to answer your queries and support your smooth transition to a better boundary element sense in analysis. Send us your questions through our customer support team e-mail and we will reply shortly. http://be4e.com/site/node/32

BENCHMARK

Efficiency of our Approach

Verifying our results achieved by the boundary element method is vital at proving that our approach works, and even better than other conventionally used methods. A simple example is provided.

The annular plate shown has an outer radius (a), inner radius (0.5a) and thickness (0.02a). The Poisson's ratio is taken to be 0.3. The inner boundary is simply supported and the outer one is free. The plate is loaded by edge load (q) along its free outer boundary. The solution of this plate was carried out using the PLPAK. The results together with the analytical results for the deflection at points (A) and (B) and the shear forces at the support point (C) are presented in Table (1) (*D* is the plate modulus of rigidity).

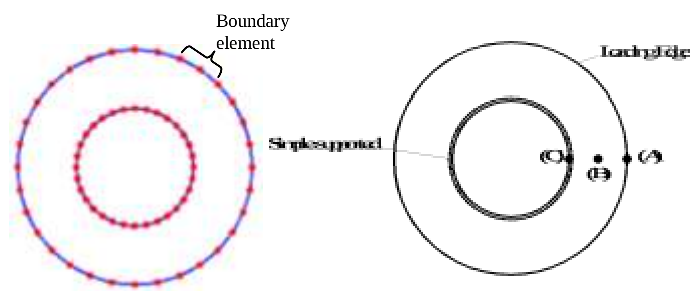


Table (1): Results for the generalized displacements at point (A, B) and shear stress resultant at point (C).

Solution Type:		$u_3(A)\times\frac{8D}{qa^3}$	$u_3(B)\times\frac{8D}{qa^3}$	$Q(C)\times\frac{-1}{2q}$
Analytical values		3.0935	1.6106	1.0000
PLPAK	16 Quadratic elements	3.0139	1.6395	0.9974
PLPAK	32 Quadratic elements	3.0974	1.6131	0.9998