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Buried Dynamic Centers of Rotation and Forced Torsional Oscillations of Multilayered Solids

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Summary

A new approach is proposed for obtaining the dynamic elastic response of multilayered elastic solid caused by a buried dynamic center of rotation and it application to the forced torsional oscillation problems. The steady state solution of the center of rotation for multilayered solids is obtained by solving a set of simultaneous linear algebraic equations using the boundary conditions for the singularity and for the layer interfaces. The solution of the forced torsional oscillation is formulated by integrating the Greena?Ts function over the contact area with unknown surface traction. The dual integral equations of the unknown surface traction are established by considering the boundary conditions on the contact surface of the multilayered solid, which can be converted into a Fredholm integral equation of the second kind and solved numerically. The steady-state solution for forced torsional oscillation on the surface of the layered half-space was obtained by letting the buried source moves to the free surface. For a single layer overlaying a half-space, the results obtained in this study agree with previous published results. Present steady-state solution for the center of rotation can be applied to the transient problems in layered media. Since the elastic wave of infinitesimal strain is linear, the transient Greena?Ts function can be obtained by superposing steady-state Greena?Ts function over the entire frequency spectrum (Fourier synthesis). In addition, the present solution also provides the necessary Greena?Ts function that can be employed in the boundary element method for numerical treatment of more complicated problems.