Green functions for an elastic layer on a rigid base and related problems

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The problem of a linearly elastic and homogeneous isotropic layer resting on a rigid base and loaded by an interior arbitrarily oriented pointwise force is studied. The displacement field is expressed in terms of convergent Fourier transforms. The solution is sought as a particular solution based on the Kelvin problem related to an infinite 2D elastic body subjected to an inner point force plus a homogeneous solution which allows satisfying both the Navier equilibrium equations and the boundary conditions at the free surface of the layer and at its bottom as well [1]. In detail, in order to obtain integrable singularities in the transformed domain, the particular solution is taken as the superposition of two Kelvin problems [2] corresponding to a couple of opposite forces (doublet state). Such an approach makes straightforward the numerical calculation of the inverse Fourier transforms of the displacements, which is handled based on the Gauss-Laguerre quadrature rule.
The obtained solution allows investigation a wide range of engineering tasks, with special reference to soil-piles interaction. Indeed, as a relevant application, the obtained solution is used to analyse the mechanical interaction between an eternally loaded elastic sheet pile embedded into the hosting elastic layer.

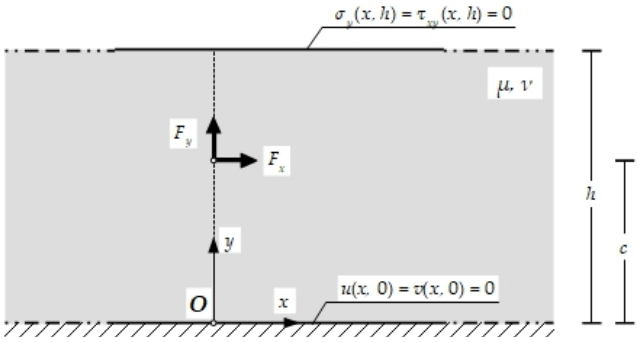

Fig. 1: A sketch of an infinitely extended layer of finite height subjected to an internal point force

References

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