Arbitrary load distribution on a layered half space

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Abstract

This paper develops a method which allows one to calculate the complete elastic field (stress field and displacements) of layered materials of transverse and complete isotropy under given load conditions. It is assumed that the layered body consists of an infinite half space and various infinite plates which are all ideally bonded to each other. Thus, the interfaces are parallel to the surface of the resulting “coated half space”. The approach is based on the method of images in classical electrostatics. The final solution for an arbitrary load problem can be presented as a series of potential functions, where corresponding functions may be interpreted as "image loads" the analogous to "image charges". The solution for the elastic field for any arbitrary stress distribution on the surface of the coated half space can be obtained in a relatively straight forward manner by using the method described here as long as the corresponding solution for the homogeneous half space is known. Further, if this solution of the homogeneous case may be expressed in terms of elementary functions, then the solution for the coated half space is elementary, too. Explicit formulae for the stress fields for some particular examples are given.

Key words: contact stress, layered material, half space, transverse isotropy, isotropy