ELASTIC PERFORMANCE OF A PLANE-DEFORMED MULTILAYER HALF-SPACE

Yuriy Tokovyy[1], Dariusz Perkowski[2], Jakub Augustyniak[3]

[1]Pidstryhach Institute for Applied Problems of Mechanics and Mathematics NAS of Ukraine, Lviv, tokovyy@gmail.com,
[2,3] Bialystok University of Technology, Bialystok, [2]d.perkowski@pb.edu.pl, [3]j.augustyniak@pb.edu.pl

In this talk, we present an extension of the direct integration method toward the elastic analysis of plane-deformed multi-layer semi-Infinite solids. The central idea implies the combination of the direct integration method and the single solid method for the analysis of stratified solids. The conventional scheme of the direct integration method allows for the derivation of the governing equation on the basis of the compatibility equation in terms of stresses. In the case of multilayer structures, this is concerned with certain complications because the material properties, which are involved into this equation, may exhibit discontinuous behavior at the layer interfaces. In order to overcome this difficulty, one may engage the generalized derivative apparatus. However, this approach is quite limited for multidimensional problems.

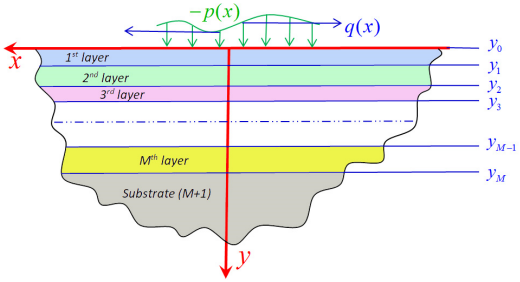

Fig 1. Scratch of the considered multilayer half-space which models a medium with a multilayer coating.

In order to overcome this difficulty, we modify the conventional scheme of the direct integration method and apply this approach towards the compatibility equation in terms of strains. In contrast to the one in terms of stresses, the former equation does not involve the material properties profiles and hence is irrespective of the mathematical model of the Hooke's law. As a result, we have managed to avoid the generalized derivatives which allowed for extension of this approach towards the multidimensional problems. We demonstrated the efficiency of this approach by constructing a comprehensive solution to a two-dimensional elasticity problem of a multilayer half-plane (Fig. 1).

The authors gratifuly acknowledge the partial finantial support of this research by the bilateral Ukainian-Polish R&D Project No. 0124U002858