High-order theory for layered and block media with slip

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Interest in the problem of propagation and transformation of waves in layered and block media is associated with seismology and engineering geophysics. Typically, the seismicity is related with the mountain areas where rocks are located near the earth's surface. Often, these rocks contain regular grid of cracks and can be considered as layered or block structures. Classic studies of wave fields in such media are usually based on the continuity of the displacement field. However, for sufficiently strong seismic effects, we should take into account the possibility of tangential motions (slips) at the boundaries of layers or blocks. For distributed effects we need to use the homogeneous, " effective" models of continuum with micro-structure, since it is impossible to examine the deformation of each element of the micro-structure [1-2]. First-order asymptotic models for layered and block media based on homogenization theory [3] were derived for nonlinear slip conditions in [4].

In this study there was obtained asymptotically justified high-order dynamic theory of layered and block media. Slip contact conditions of Winkler's type are taken into account on the contact boundaries of layers or blocks. The resulting system of differential equations is a system of fourth order in space and second order in time.

The additional investigations of this differential systems were made: the wave properties of the models, dispersion relations were derived . The solutions were obtained for some problems of the transformation of elastic waves in passing through the layered and block geostructures and for wave incidence on the earth's surface. The results are used as input data in calculating the seismic effects on building constructions in seismic regions.

Also, the resulting model of block medium can be used to calculate the stress-strain state and possible damage or destruction of the block (masonry) building constructions in the problems of structural mechanics [5].

References

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