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## Mathematical Modeling Algorithms for Obtaining New Materials with Desired Properties Using Nano-hierarchical Structures.

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In the enormous and still poorly mastered gap between the macro level, where the well-developed continuum theories of continuous media and engineering methods of calculation and design operate, and the atomic, subordinate to the laws of quantum mechanics, there is an extensive meso-hierarchical level of the structure of matter. At this level unprecedented previously products and technologies can be artificially created. Nano technology is a qualitatively new strategy in technology: it creates objects in exactly the opposite way - large objects are created from small ones [1]. We have developed a new method for modeling acoustic monitoring of a layered-block elastic medium with several inclusions of various physical and mechanical hierarchical structures [2]. An iterative process is developed for solving the direct problem for the case of three hierarchical inclusions of  $l$ ,  $m$ ,  $s$ -th ranks based on the use of 2D integro-differential equations. The degree of hierarchy of inclusions is determined by the values  $\alpha_l, \alpha_m, \alpha_s$  of their ranks, which can be different while the first rank is associated with the atomic structure, the following ranks are associated with increasing geometric dimensions, which contain inclusions of lower ranks and sizes. Hierarchical inclusions are located in different layers one above the other: the upper one is abnormally stressed, the second is abnormally elastic and the third is abnormally dense. The degree of filling with inclusions of each rank for all three hierarchical inclusions is different. Modeling is carried out from smaller sizes to large inclusions; as a result, it becomes possible to determine the necessary parameters of the formed material from acoustic monitoring data.

### References

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