The role of the generalized derivative in modeling the microstructural features of a heterogeneous system

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When analyzing a heterogeneous system, it is necessary to take into account its microstructural features: physical and geometric (sizes) properties of phases and their contact interactions. Currently existing works [1] do not contain a solution to the problem. For the purpose of analytically exploring the microstructural features of a heterogeneous system, a mathematical concept of the derivative in a generalized sense is introduced [2, 3]. Generalized derivative has a singular component, which reflects the internal boundaries of the heterogeneous system. As a result of the operators modification in the original model of the linear theory of viscoelasticity, the Green's function contains the microstructural features of the heterogeneous system. Using the method of conditional moments [1], the effective coefficients of viscoelasticity (included in the averaged equations) taking into account the microstructure of the system [3] are obtained. From the analysis of the found effective coefficients the conditions for the carrier phase and the structural phase transition are established. Based on the relations obtained for the structural phase transition, signs of the correspondence between the investigated structural phase transition (percolation) and phase transitions of the first and second order are found. The effective coefficients are compared with experiment. The work is supported by the Russian Science Foundation (grant No. 21-19-00733).

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