Application of the Potential Method to Mixed Boundary Value Problems for Viscoelastic Solids with Voids

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We investigate mixed boundary value problems (BVP) of the linear theory of viscoelasticity for isotropic and homogeneous Kelvin–Voigt materials with voids when on one part of the boundary of the body under consideration the Dirichlet type condition is given and on the remaining part of the boundary the Neumann type condition is prescribed. Using the potential method and the theory of pseudodifferential equations we prove the existence and uniqueness of solutions in the appropriate Sobolev–Slobodetskii, Bessel potential, and Besov spaces. Using the embedding theorems, we establish almost optimal regularity results for solutions to the mixed BVPs near the collision curves where different types of boundary conditions collide. In particular, we prove that the solutions belong to the space of Hölder continuous functions in the closed region occupied by the viscoelastic body. An efficient algebraic algorithm is described for finding the Hölder smoothness exponents which, in turn, efficiently determined the corresponding stress singularity exponents near the collision curves. It is shown that these exponents depend essentially on the material parameters.