ELASTODYNAMICS PROBLEMS IN DOMAINS WITH EDGES

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Summary. Basic initial-boundary value problems of elastodynamics are considered in a domain of general type with edges on the boundary, in particular, with cracks and conical points. The asymptotics of solutions near the singularities is obtained and justified.

Initial-boundary value problems of elastodynamics are considered in a domain of general type whose boundary may contain conical points and non-intersecting smooth edges. The Dirichlet and Neumann conditions (homogeneous and non-homogeneous) are imposed on the boundary. We study the behavior of solutions near the singularities of the boundary. To this end we investigate the solvability of the problems in a scale of weighted spaces, obtain and justify the asymptotics of solutions near the edges, derive explicit formulas for the coefficients in the asymptotics. We briefly describe the results for a domain G with conical point O. The principal part of the asymptotics of a solution near O is a linear combination $\sum c_j(t)\ u_j(x)$ of the functions u_j satisfying a homogeneous elliptic problem in the "tangent" cone; such a problem is the elliptic part of the initial hyperbolic problem. The hyperbolic character of the asymptotics manifests itself in the coefficients c_j that are functions in time. In the case of homogeneous boundary and initial conditions, the coefficients admit representation of the form

$$c_j(t) = \int\limits_G \int\limits_{\mathbb{R}} f(x, t-s)\overline{w_j(x,s)}dxds,$$

where f is a right-hand side of the problem and w_j is a solution to the corresponding homogeneous problem, singled out by its (growing) asymptotics near the conical point. For some model problems the functions w_j are calculated explicitly(for the wave equation in a cone, in a corner, in a plane with a half-infinite crack). Using these explicit formulas for w_j, we observe some phenomena in the coefficients c_j, for example, "the back front of singularities": the coefficients become smooth after the perturbation going from the singular support of an external load (i.e., from the singularities of the load) has left the vertex of cone. We also discuss the reaction of coefficients at the moment when a perturbation approaches the vertex. Part of the results was obtained jointly with A.Kokotov and P.Neittaanmaki.