ON THE RAYLEIGH WAVE FIELD INDUCED BY A NEAR-RESONANT MOVING LOAD

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The near-resonant regimes of a moving load on an elastic half-space are studied. The consideration starts from the asymptotic model for the Rayleigh wave, proposed in [1]. The model extracts the contribution of the Rayleigh wave to the overall dynamic response reducing the original vector problem of elastodynamics to a scalar problem for an elliptic equation with the Dirichlet boundary condition given by a hyperbolic equation on the surface.

The transient plane strain problem for a concentrated force moving along the surface of an elastic half-space is considered, see [2] and references therein. The aforementioned model involves a moving load problem for a string, immediately revealing the resonant nature of the Rayleigh wave speed. The associated interior field is expressed in terms of elementary functions in contrast to a rather complicated integral solution within the full elastodynamic formulation. A straightforward analysis of the derived approximate formulae leads to a number of important physical conclusions.

The proposed approach is then extended to the 3D case, demonstrating significant distinctions from the plane strain problem, see [3] and references therein. In particular, 3D surface dynamics is described by an elliptic equation for the sub-Rayleigh regime and a hyperbolic equation for the super-Rayleigh regime along with a Mach-type cone travelling not only behind of the load, but also in front of it. Another distinction is related to the form of the resonance, which is a pole within the 2D case and a branch point in the 3D case.

Finally, the proposed methodology is extended to mixed problems modelling moving cracks and stamps and is also adapted for a coated half-space.

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REFERENCES

