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EXPLICIT MODELS FOR SURFACE WAVES IN PRE-STRESSED ELASTIC HALF-SPACE

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Surface waves in a pre-stressed elastic half-space are discussed within the framework of plane-strain assumption, see e.g. [1, 2]. The presented analysis extends the asymptotic theory for the Rayleigh waves induced by prescribed surface stresses exposed in [3], incorporating the effect of pre-stress.

The consideration starts from the representation of the surface wave field in terms of a single plane harmonic function, see e.g. [4], which is then perturbed in slow time. The leading order analysis gives the surface wave eigensolution, whereas the correction provides a hyperbolic-elliptic model. As a result, the vector problem in elasticity is reduced to a scalar one for a pseudo-static elliptic equation, with the boundary condition on the surface in the form of a 1D wave equation. In addition, the effect of incompressibility is addressed [5], with the coefficient in the right hand side of the hyperbolic equation on the surface blowing up near the bounds of stability of surface wave.

As might be expected, the resulting approximation for the surface wave field is of interest when the contribution of the studied wave is dominant compared to that of the bulk wave, including far-field or near-resonant regimes. As an example, the obtained formulation is implemented to a problem for a concentrated impulse load, moving steadily at a constant speed along the surface, allowing a straightforward approximation for surface wave field in terms of elementary functions.

Finally, further generalisations are discussed, including general anisotropy, accounting for the action of embedded sources, as well as inhomogeneity of the media.

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ON CRACK PROPAGATION IN A TWO-COMPONENT THERMALLY REINFORCED PIPE

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The losses induced by cracks propagation in oil and gas pipelines may be minimized by creating conditions for cracks arrest and controlling their trajectories. One of the effective approaches to the retardation of cracks in pipes was introduced in [1]. For the manufacture of pipes it is proposed to use periodically thermally reinforced rolled sheet. The phase boundaries in the crack path reduce the rate of its propagation and change its trajectory. The direction of the crack propagation may be controlled by the configuration of these boundaries. The paper presents experimental and theoretical results concerning the crack propagation near the strengthened strips in steel sheets and model pipes. The angles of inclination of the strengthened strips with respect to generatrix of the pipe's cylindrical surface are determined, contributing to the most effective reduction of the destroyed part of the pipe. Some possible dynamics effects are discussed.

References

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