ARCHIVES OF ACOUSTICS
35, 1, 67–74 (2010)

Rayleigh Waves in an isotropic Body with Deep Periodic Grooves

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(*received September 2, 2009; accepted November 25, 2009*)

Bragg scattering of waves propagating in a periodically disturbed substrate is widely applied in optics and micro-acoustic systems. Here, it is studied for Rayleigh waves propagating on a periodically grooved elastic substrate. Practically applied groove depth in the Bragg grating reflectors does not exceed a few percent of the Rayleigh wavelength. Here, the analysis is carried out for periodic grooves of larger depth by applying the elastic plate model for the groove walls. The computed results show that the surface wave existence and reflection depends strongly on both the groove depth and period, and that there are limited domains of both for practical applications, primarily in comb transducers of surface waves.

Keywords: surface acoustic waves, Bragg reflection, comb transducers.

1. Introduction

Wave scattering and propagation on a grooved surface of elastic body was the subject of investigations for years (BREHOVSKICH, 1957; GLASS, MARADUDIN, 1983). Most research works concerned shallow grooves (BIRIUKOV *et al.*, 1995; DANICKI, 1984) where the perturbation method was applicable. Here, we analyze deep groove-gratings, or equivalent systems of periodic teeth (the groove walls), where perturbation theory cannot be applied.

In (DANICKI, 2008), we proposed treating elastic teeth as pieces of an elastic plate. The concept was proven for shallow grooves; the results nicely converged to these obtained by perturbation analysis. Next two sections shortly outline the applied approach (DANICKI, 2008) for evaluation of the tooth harmonic impedance which is subsequently used in formulation of the boundary-value problem under consideration. Elevated teeth are typically applied in ultrasonic comb transducers of surface waves (QUARRY, ROSE, 2002; VIKTOROV, 1967;

their transformation loss at the transducer edges due to the mode mismatch (DANICKI, 2002).

Acknowledgment

The author acknowledges partial support by the State Committee for Scientific Research under Grant No. N-N 501-0072-33.

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