RAYLEIGH WAVE PROPAGATION IN CURVED WAVEGUIDES

JOHN G. HARRIS
THEORETICAL AND APPLIED MECHANICS, UIUC (EMERITUS)
NORTHWESTERN UNIVERSITY (VISITING)

Abstract

A JWKB asymptotic expansion of inplane elastic waves is used to approximate Rayleigh-like waves within a waveguide, whose curvature is small and changes slowly. Propagation in a thin and thick guide are examined. It is found that the two lowest modes, that together comprise a Rayleigh-like wave, lie in the shadow of a shear-wave virtual caustic. If the curvature becomes too large the caustic enters the guide after which Rayleigh-like waves cannot propagate. Rayleigh-like waves, in a thin curved waveguide, can be launched on either the upper or lower surfaces by exciting the two lowest modes in-phase or π radians out-of-phase, respectively, As they propagate their amplitude tends to drift to the surface opposite that on which they are launched. Rayleigh waves in a thick guide cling solely to the surface on which they are launched, and their wavenumber exhibits a linear dependence on curvature.

John G. Harris received an undergraduate degree (honours) in 1971 from McGill University, where he studied electrical engineering and gained his interest in wave propagation. In 1979 he received a doctoral degree in applied mathematics from Northwestern University for a thesis on elastic-wave diffraction and radiation problems. Following this he joined the Theoretical and Applied Mechanics Department at the University of Illinois, where he has served in the trenches for the past 21 years. Having caught David Abrahams breaking into the Chancellors' Centre, through a second floor window, he inveigled David into offering him an invitation to visit Manchester.