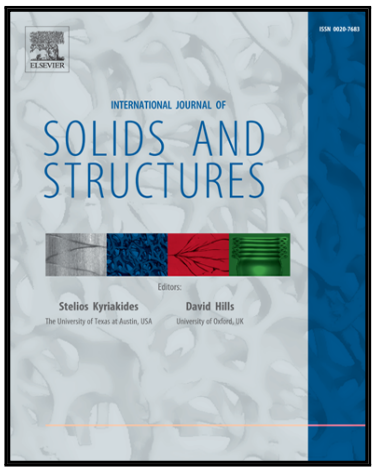

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N.T. Nam, J. Merodio, R.W. Ogden, P.C. Vinh

PII: S0020-7683(16)00138-4
DOI: 10.1016/j.ijsolstr.2016.03.019
Reference: SAS 9107

To appear in: *International Journal of Solids and Structures*

Received date: 8 October 2015
Revised date: 25 January 2016
Accepted date: 19 March 2016

Please cite this article as: N.T. Nam, J. Merodio, R.W. Ogden, P.C. Vinh, The effect of initial stress on the propagation of surface waves in a layered half-space, *International Journal of Solids and Structures* (2016), doi: 10.1016/j.ijsolstr.2016.03.019

The effect of initial stress on the propagation of surface waves in a layered half-space

N.T. Nam[1], J. Merodio[1], R.W. Ogden[2], P.C. Vinh[3]

[1]Department of Continuum Mechanics and Structures,
E.T.S. Ing. Caminos, Canales y Puertos,
Universidad Politecnica de Madrid, 28040, Madrid, Spain

[2]School of Mathematics and Statistics, University of Glasgow,
Glasgow G12 8QW, United Kingdom

[3]Faculty of Mathematics, Mechanics and Informatics,
Hanoi University of Science,
334, Nguyen Trai Street, Thanh Xuan, Hanoi, Vietnam

Abstract

In this paper the propagation of small amplitude surface waves guided by a layer with a finite thickness on an incompressible half-space is studied. The layer and half-space are both assumed to be initially stressed. The combined effect of initial stress and finite deformation on the speed of Rayleigh waves is analyzed and illustrated graphically. With a suitable simple choice of constitutive law that includes initial stress, it is shown that in many cases, as is to be expected, the effect of a finite deformation (with an associated pre-stress) is very similar to that of an initial stress (without an accompanying finite deformation). However, by contrast, when the finite deformation and initial stress are considered together independently with a judicious choice of material parameters different features are found that don't appear in the separate finite deformation or initial stress situations on their own.

Keywords: nonlinear elasticity, initial stress, surface waves, secular equation

1 Introduction

Guided wave propagation provides an important non-destructive method for assessing material properties and weaknesses in many engineering structures. In the absence of initial stress (residual stress or pre-stress) the classical theory of linear elasticity has been applied successfully in the analysis of such structures. One problem of special interest is