

## Accepted Manuscript

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PII: S0020-7683(16)00138-4  
DOI: [10.1016/j.ijsolstr.2016.03.019](https://doi.org/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](https://doi.org/10.1016/j.ijsolstr.2016.03.019)

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

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## 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

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