Journal of Thermal Stresses, 38: 569–590, 2015

ISSN: 0149-5739 print/1521-074X online
DOI: 10.1080/01495739.2015.1015837

Taylor & Francis
Taylor & Francis Group

VIBRATIONAL ANALYSIS FOR AN AXIALLY MOVING MICROBEAM WITH TWO TEMPERATURES

E. Carrera[1,4], A. E. Abouelregal[2,5], I. A. Abbas[3,6], and A. M. Zenkour[4,7]

[1]*Mechanical and Aerospace Department, Politecnico di Torino, Italy*
[2]*Department of Mathematics, Faculty of Science, Mansoura University, Mansoura, Egypt*
[3]*Department of Mathematics, Faculty of Science and Arts-Khulais, King Abdulaziz University, Jeddah, Saudi Arabia*
[4]*Department of Mathematics, Faculty of Science, King Abdulaziz University, Jeddah, Saudi Arabia*
[5]*Department of Mathematics, College of Science and Arts, University of Aljouf, El-Qurayat, Saudi Arabia*
[6]*Department of Mathematics, Faculty of Science, Sohag University, Sohag, Egypt*
[7]*Department of Mathematics, Faculty of Science, Kafrelsheikh University, Kafr El-Sheikh, Egypt*

In this article, the effect of two temperatures on an axially moving microbeam subjected to ramp-type heating is studied. The generalized thermoelasticity theory with one relaxation time model is used. The governing equations are expressed in Laplace transform domain. Based on Fourier series expansion technique, the inversion of Laplace transform is done numerically. Some comparisons have been shown in figures to present the effect of the temperature discrepancy and the transport speed on all the studied field quantities. Additional results across the thickness of the microbeam are presented graphically.

Keywords: Moving microbeams; Ramp-type heating; Thermoelasticity; Two temperatures

INTRODUCTION

Axially moving beams represent many engineering devices, such as band saws, crane hoist cables, flexible robotic manipulators, power transmission belts, aerial cable tramways, and spacecraft deploying appendages. Despite usefulness and advantages of these devices, vibrations associated with the devices have limited their applications. Therefore, understanding transverse vibrations of axially moving beams is important for the design of the devices. The investigations on vibrations

Received 25 May 2014; accepted 6 August 2014.
Address correspondence to E. Carrera, Mechanical and Aerospace Department, Politecnico di Torino, Italy. E-mail: erasmo.carerra@polito.it
Color versions of one or more of the figures in the article can be found online at www.tandfonline.com/uths.