ABSTRACT
NANOMEC-06
Bari, Italy, 2006

MEMS photonics system

Cosme Furlong and Ryszard J. Pryputniewicz
NEST – NanoEngineering, Science, and Technology
CHSLT – Center for Holographic Studies and Laser micro-mechaTronics
Mechanical Engineering Department
Worcester Polytechnic Institute
100 Institute Road, Worcester, MA 01609
E-mail: cfurlong@wpi.edu, phone: (508) 831-5126, fax: (508) 831-5713

ABSTRACT

Miniaturization and increased functionality of microelectromechanical systems (MEMS) for photonics applications require construction of complex three-dimensional structures. Some of these structures are made using multilayer sacrificial surface micromachining (SSM), which allows construction from parts fabricated in a plane of a wafer by actuating these parts to extend hundreds of microns in the direction normal to the fabrication plane. One such structure is a **MEMS photonics system** comprising of a hinged positionable micromirror actuated by an electrostatic microengine. This device can be used to reflect light beams capable of triggering, or activating, sensors and other circuitry. Therefore, positional repeatability of a reflected beam impinging on a target must be determined with high accuracy and precision. Until recently, this determination was hindered by lack of suitable methodologies. However, building on advances in laser technology, electronics, and computational analyses, we have developed a new optoelectronic methodology to quantitatively characterize *nanoscale effects* of MEMS in motion. In addition, in order to determine forces acting on various components of the device, we have also developed an analytical model to study its *kinematics and kinetics*. In this paper, the methodology for study of positional reliability of MEMS photonics systems/devices is described and its use is illustrated with representative examples.

Keywords: MEMS, photonics, positional reliability, optoelectronic methodology, nanometer deformations.