TAS Journal, vol. 2, n. 3, p.15c.
SEPTEMBER **2018**
ISSN: 2595-1521
marcelots@ipt.br

Membrane shaping by low coherence speckle interferometry for pressure measurement

Saita MT*‡, Barbosa EA*, Degasperi FT*, Wette NU§.

** Centro Estadual de Educação Tecnológica Paula Souza, São Paulo, Brasil.*

‡Instituto de Pesquisas Tecnológicas, São Paulo, Brasil.

§ Instituto de Pesquisas Energéticas e Nucleares, São Paulo, Brasil.

Abstract. In this work we developed a novel pressure measurement technique based on the deformation evaluation of a membrane submitted to a pressure differential. The deformed membrane shape was determined by low-coherence speckle interferometry. In this method, a tunable diode laser at 660 nm emitting simultaneously two or more longitudinal modes illuminates the optical setup. The resulting speckled low spatial frequency interferogram of the image corresponding to the membrane shape was evaluated by conventional 4-stepping and phase unwrapping analyses. The sensitivity of the measurement process was controlled by tuning the laser with the help of the Littman-Metcalf arrangement using a 2380 lines/mm reflective diffraction grating, which provided a tunable range of 3 nm. The 0.420 mm thick aluminum membrane was submitted to pressure values from 0 to 90 kPa and a curve of the maximum membrane deformation as a function of the pressure was obtained. The experimental results were compared with the ones obtained by a numerical algorithm.

Key-words. *Speckle, Interferometry, Deformation, Pressure.*

Introduction. Along the years the employ of interferometry for pressure measurement was proposed by several authors (1-6). Those techniques basically measure the deformation of membranes or diaphragms in the range from hundreds of micrometers up to several millimeters. In this framework we propose the deformation measurement of a membrane submitted to a pressure differential by low coherence speckle interferometry. For this purpose the interferometer is illuminated by a tunable diode laser, which allows selecting the most suitable emission parameters according to a required sensitivity (7). In addition, low coherence techniques do not require very severe stability conditions, if compared with other conventional interferometry methods (8).