

855. 3D holographic visualization of vibrations of cylindrical piezoceramic transducers

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Abstract. The piezoelectric material used in cylindrical transducers requiring high-precision displacements indicates that accuracy depends on design and technological factors. The analyzed criteria have enabled selection of piezoelectric material for optimal mechatronic systems having maximum displacement. Experimental investigation of precision dynamic systems by means of 3D holographic visualization enabled to collect appreciably more information about the vibrating surface in comparison with traditional methods. The developed methodology of analysis of experimental data derived from 3D holographic visualization using holographic measurement stand allowed to obtain results that are indispensable for optimization of design of mechatronic systems or its constituent elements.

Keywords: piezomaterial, mechatronics systems, 3D holographic visualization, cylindrical transducers vibrations.

Introduction

Piezoceramics can be significantly more sensitive to electric and mechanical effects compared to natural crystals. In addition, it is mechanically strong, chemically inert and resistant to atmospheric effects. Piezoelectric cells can be made of various sizes and parameters which enable them to be used in any manufactured structures with 90 % efficiency. Theoretical investigation of vibrations of cylindrical transducers and dynamic analysis of their components have indicated that increase in the loading force and initial tension decrease the harmonic components of fluctuations (Figs.1-2).

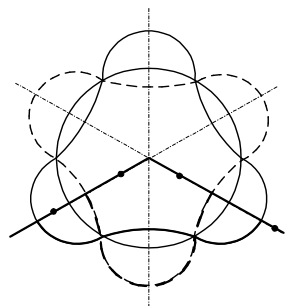


Fig. 1. Mode of vibration in a cylindrical transducer

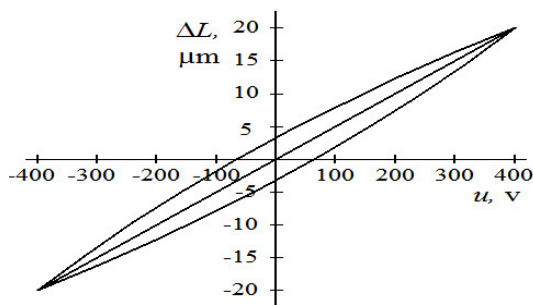


Fig. 2. Hysteresis loops corrected in cylindrical transducers vs. the feedback value

Fig. 3 shows an interferogram when a control signal is sent only to one active control cylindrical transducer of the mechatronic system. In this case, even deformation of the working part surface in the operation area of the active cylindrical transducer is observed. Slight surface deformation in the operation areas of other active piezostack emerges due to conditions of their fixing onto the surface of the working part of the mechatronic system.