

## **Abstract**

The master's thesis contains 98 pages, 42 figures, 25 tables, 35 references.

Keywords: ultrasound, capacitive ultrasonic transducers, medical diagnostics, excitation of acoustic vibrations.

The work is aimed at solving the problem of designing capacitive-type ultrasonic transducers for medical diagnostics systems.

Based on the analysis of world experience, the efficiency of small-size high-frequency converters for their excitation by relatively low voltages has been evaluated. Experimental studies have been conducted to confirm the physical processes of oscillation excitation.

Piezoelectric transducers have long been the dominant technology in ultrasonic transducers, but capacitive micromechanical ultrasonic transducers have recently emerged that offer significant advantages such as wide bandwidth, ease of fabrication of large array elements and potential for integration and interoperability. EMUP is a simple device with two plate-like electrodes, offset by constant voltage and excitation by an additional variable signal for the harmonic oscillation of one of the plates.

EMUs offer a number of advantages over piezoelectric converters: they can be manufactured in batches with micro-processing technologies that provide rigid parameter specifications, which are difficult to achieve in the case of piezoelectrics and are easier to manufacture than piezoelectric converters. The batch production technologies also allow the manufacture of arrays of converters with different operating frequencies on the same plate and converters of complex shape.

The purpose of the study is to improve the electromechanical coupling coefficient and the mechanical characteristics of the capacitive converters by increasing the excitation voltage and analyzing the results obtained.

### **Objectives of the study:**

1. Analysis of the state of the art of technologies of excitation of mechanical vibrations and physical essence of the process of excitation of oscillations with the use of capacitive ultrasonic transducers.

2. Develop the design of the converter and implement it in the form of a prototype.

3. Experimentally investigate the physical process of oscillation, determine the optimal amplitudes of the exciting voltage.

4. Develop a circuit for excitation of oscillations.

5. Investigate possible ways to increase the efficiency of oscillation excitation.

**The object** of study is the process of excitation of ultrasonic vibrations by capacitive micromechanical ultrasonic transducers.

**The subject** of the study is the method of ultrasound excitation by capacitive transducers and the technical implementation of this process.