# DISPLACEMENT ESTIMATION METHODS FOR ELASTOGRAPHY – A PHANTOM STUDY

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*Estimation of shift between signals of two ultrasound images is the key of sonoelastography. Comparison of three methods – cross-correlation function and two versions of SAD (sum of absolute differences) has been conducted for various displacements and estimation parameters using a soft tissuemimicking gelatin phantom with harder inclusion. Resulting displacement maps were evaluated by comparison of average values and their standard deviations.*

Key words: *elastography, sonoelastography, phantom, strain, displacement*

## 1. Introduction

Elastography is a new application of ultrasound in medical diagnostic. This term describes a method for visualization of elastic properties of tissue. Images produced using this method are called elastograms [3, 11]. Elastic properties of certain types of tissue, especially cancerous, are different from those of healthy living tissue. They are usually harder. For many years most of cancers were discovered by means of palpation, which is still widely used for localization of harder tumors, for example breast cancers. Therapeutic usefulness of this method is limited to pathological changes located close to the skin surface. Most of visualization methods (CT, classical 2D ultrasound scanning) do not allow direct assessment of elastic properties of tissue. Imaging of those properties would be a valuable complement of other diagnostic techniques.

Analysis of displacements within examined organ, caused by external force, allows to detect the areas of increased hardness, as for example in case of breast or prostate cancer [1, 7, 9]. Other proposed applications of elastography are for detection of pathological changes within kidneys [2] and examination of coronary vessels [12]. Elastography can also be useful in detection of lesions within heart muscle [5, 6]. In this case deformations result from cardiac contractions. Analysis of strain within heart walls allows assessment of passive areas of heart muscle, which can be a result of cardiac infraction.

From medical point of view aim of elastography is to detect areas of tissue with different elastic properties then the surrounding healthy tissue [3, 10, 11]. First step to determine mechanical properties of the examined object is to assess the displacements of the structure observed during deformation. Displacements recorded during ultrasound scanning can be determined by means of analysis of signal structure changes between two separate scans. For those purposes only signals from early stage of signal processing are suitable (RF or base-band). Classical 2D ultrasound image lacks information necessary for displacement assessment.

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