

# 900. Experimental research of vibrations of angle measurement comparator

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**Abstract.** The aim of the presented research was to determine calibration error caused by mechanical instability of angle measurement comparator system. Vibrations were measured at the significant points of the system and dynamic characteristics of the system were subsequently established.

**Keywords:** angle measurements, comparator, dynamic characteristics.

## Introduction

Despite achieved progress in the research in the field of metrology, precise mechatronic systems are typically too complex and it is difficult to adapt these achievements to them directly. Design and development of such mechatronic systems would be based on the research findings obtained from very specific field of study. For example, calibration error is the unique characteristic of angle measurement comparator, because it and its components depend on specific measurement conditions.

One of the main criterions of design of such mechatronic systems is the error budget (structure), which regulates the ranges of errors that can be tolerated at every design, production and use stage of the life cycle of the system. It is not aimed to reduce the errors, but to control them and their impact. Therefore it is necessary to determine dominating errors, investigate possibilities to compensate them and establish the impact of these errors on calibration error budget.

Consequently, precise mechatronic systems are designed based on precision engineering principles, which consolidate their own distinctive approach to the synthesis of such systems. The knowledge and appropriate application of these principles requires systematic understanding of the problems, deep knowledge, and ability to analyze, evaluate and synthesize new complex ideas. It is very important that the designed precision equipment would be mechanically stable and its dynamic characteristics would be established [1-7].

The aim of this research work is to evaluate vibrations of elements of the angle measurement comparator system caused by its mechanical instability. The following investigations of dynamic stability of mechanical parts of the comparator were performed:

Vibrations of concrete foundation of the comparator were measured and analyzed;

Vibrations of comparator base (granite plate and support) were measured and analyzed;

Vibrations of granite guide and carriage were measured and analyzed in cases of foundation external excitation and shock excitation;

Results of experimental investigation were used to improve the design of angle measurement comparator.

## Experimental technique and results

**Experimental means.** Vibrations were measured and analyzed using following "Brüel&Kjær" equipment: LAN-XI Type 3660-D data acquisition hardware, computer and accelerometers (Mod. 8344).