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ACOUSTIC PRESSURE FIELD MAPPING SYSTEM AT LABORATORY OF ULTRASOUND OF INMETRO

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Abstract: The acoustic pressure field mapping system of Ultrasound Laboratory (Labus) of Institute of Metrology, Standardization, and Industrial Quality (Inmetro) is being implemented, based on Standard IEC-61102. This system will be capable to estimate ultrasound pressure field parameters from biomedical transducers, essential step to calibration and certification of ultrasound equipments. The data acquisition is carried out on a water bath, where a positioning system moves a hydrophe, which produces electrical signals in response to waterborne acoustic signals, over the transducer acoustic field. This work presents the implementation of acoustic pressure field mapping system, based on IEC-61102 that defines the necessary steps to acoustic beam assessment and calibration.

Keywords: acoustic beam, metrology, ultrasound.

1. INTRODUCTION

Technology advances each day and embraces more and more aspects of human lives. This fact brings together the need for some kind of standardization of the technological products and services so that it can be useful and safe for the society. Medical technology is one of the fields that deserve most of this attention. Medical Ultrasound (US) is actually a well-established technology in routine medical procedures for diagnosis as well as for therapy.

Several entities around the world are responsible for studying and regulating the safe use of ultrasonic radiation for medical purposes. Among them is the International Eletrotechnical Commission – IEC and the American Institute for Ultrasound in Medicine – AIUM and in Brazil, the Brazilian Association for Technical Norms – ABNT [1].

In the specific case of medical US, the main concern is the levels of intensity irradiated through the patient's body, for there can be possibilities of generation of heat, shock waves and cavitation that can be dangerous for the biological tissues [1].

The reference standard to the depiction of acoustic beams is the IEC-61102, "Measurement and characterization of ultrasonic fields using hydrophones in the frequency range 0.5 MHz to 15MHz" (1991), which point out the most important parameters and procedures to measure acoustic pressure fields [2].

This work presents the implementation of acoustic pressure field mapping system of Ultrasound Laboratory (Labus) of Institute of Metrology, Standardization, and Industrial Quality (Inmetro), based on IEC-61102.

2. STANDARD IEC-61102

The Standard IEC-61102 (1991) presents the conditions required to assess the acoustic pressure field, where the primary level measure is performed using hydrophones. This standard specifies methods to carry out underwater measurements to medical ultrasound equipments on the frequency range 0.5 MHz to 15 MHz [2] and point out the acoustic parameters that must be measured (pressure parameters), calculated (intensity parameters), and the respective measurement procedures [2].

3. MAPPING SYSTEM

The Ultrasound Laboratory (Labus) of Institute of Metrology, Standardization, and Industrial Quality (Inmetro) is being structured with a mapping system and a computerized system to control the positioning system, acquire the data and calculate the parameters. The necessary knowledge to this implementation is presented on standard IEC-61102, the scientific related literature and the Master Thesis [3] done at Biomedical Engineering Program / COPPE / UFRJ, which author currently works at Labus.

The first step was achieved with the construction of the water bath measuring 1700 mm x 1000 mm x 800 mm, enough to perform all kind of measurement. The positioning system, being specified, will present Y and Z axis with travel of 300 mm and X with 600 mm. Each axis will present a resolution and repeatability of 1.25 μm.

The acquired needle hydrophones present active elements of 0.04 mm, 0.2 mm and 0.5 mm and the software has been developed in LabVIEW (National Instruments Corporation, Austin, TX, USA), as a tool to control the positioning system and also calculate the essential parameters.

4. CONCLUSION

In spite of the ultrasonic technology is well established in Brazil during the last decade, there is a need of

laboratories with official approval to perform calibration and certification of ultrasound equipment. Consequently, the Labus/Inmetro is creating the infrastructure to support this demand.

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