Bypassing Obstacles in MRI Guided Ultrasound (Ramot)

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Gil Navon, T.A.U Tel Aviv University, Exact Sciences, School of Chemistry

The Technology

An optic holographic technique, used to reduce acoustic energy density on obstacles inside a high-intensity focused ultrasound (HIFU) path. The holograms are generated using a newly developed algorithm, based on the Gerchberg-Saxton (GS) algorithm and fit to the linear acoustical equations used in ultrasound (US) intensity patterns.

The Need

In HIFU a focused ultrasound is used to heat and destroy diseased tissue. This is a minimally invasive technology for a constantly growing variety of clinical applications, including treatment of various tumors, (such as liver, lung, breast, prostate, brain and kidney) and even treatment of uterine fibroids. Due to tissue aberrations and "obstacles", optimal focal intensity is not always achieved and the acoustic waves are shifted and distorted. Obstacles could be calcifications, ribs bones or air-bubbles that have different acoustic properties than the surroundings. These absorbers are a potential risk for the US therapy due to unwanted heating outside the focus region. Magnetic Resonance Acoustic Radiation Force Imaging (MR-ARFI) also known as Magnetic Resonance Guided Ultrasonic Therapy (MRgFUS) is used as a focusing tool. The proposed technology provides correction of aberrations, allowing for improved focus of the HIFU.

Advantages

The novel feature of the algorithm is its superior performance by producing flexible intensity shapes in 3D and in higher efficiency and uniformity than other algorithms, e.g. geometrical approach and time reversal.

Stage of Development

Experimental data on transcranial therapy.

Patents

A Provisional Patent Application

Supporting Publications

Ultrasound Focusing Using Magnetic Resonance Acoustic Radiation Force Imaging: Application to Ultrasound Transcranial Therapy; Med. Phys., 37, 2934-2942 (2010)
Bypassing Absorbing Objects in Focused Ultrasound using Computer Generated Holographic Technique; Med. Phys., 38, 6407-6415, (2011)

Contact for more information:

Noam Greenspoon ✉,

Ramot at Tel Aviv University Ltd. P.O. Box 39296, Tel Aviv 61392 ISRAEL
Phone: +972-3-6406608
Fax: +972-3-6406675