3D Electromagnetic Tomography: Technology for Simultaneous Body Scanning and Biomedical Imaging

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Abstract

Electromagnetic Tomography (EMT) is a novel imaging modality applicable forfunctional imaging of biological tissues [1]. The technology uses very low, safe level of electromagnetic radiation within RF-to-high MW portion of electromagnetic spectrum.
Time resolution of the technology (within [msec] range [2]) together with low costing and ability for functional imaging are few of its' competitive advantage. There is an increasing demand for 3D body scanning technologies, for example in plastic and/or reconstructive surgery, custom orthopaedic and an individual, custom fit footwear. We propose a 3D EMT technology for simultaneous application for both body scanning and biomedical imaging. This allows for both the design of an individual, body applicable items (for example implants or wear) and an assessment of the influence of such items on effected biological tissues. Giving high time resolution of the technology it opens up an opportunity for dynamic "body scanning – tissue imaging" technology in such a way that the functionality of designed body applicable items is clearly understood during a design phase and tested in practical phase.
One of potential applications of such an approach is to design and test individual, custom fit footwear, for example an inner-boot of skiboot. The comfort and functionality of inner boot is crucial not only for professional skiers but also for millions of ski enthusiasts. The approach was tested in simulating experiment using a simplified 2D model of human lower leg comprising of two bones (the larger tibia and the smaller fibula) surrounded by muscle tissue. Two cases were studied: normal wear and tight, pressurising wear. Non-linear imaging approach was used to obtain both body surface and to reconstruct an image of lower leg. A potential applicability of simplified linear approach for surface scanning is discussed.

References

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