magnetic hyperthermia and ultrasonic hyperthermia may work synergistically, rather than independently, to produce a more efficient treatment.

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Military Airport Noise Modelling

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Accurate modeling of a military aircraft noise is much more complex, than modeling of an civil aircraft noise. Three main reasons of this situation can be identified. Polish legal regulations recommends aircraft noise prediction methodology based on ICAO Circular 205 – AN/1/25/1988 document and implemented in INM software. Since this method and software was originally developed in the USA there is lack of non-NATO aircraft data in this software, and several of these aircrafts are still in use in Poland. Second reason is more complex traffic structure at the military airports compared to the civil airports. Except standard approach and departure operations there are several specific types of other training operations at the military airports. Third reason of the complexity in military airport noise modelling is that profiles of military aircrafts – specially high performance aircrafts (opposite to the civil airplanes) can significantly differ from those standard profiles implemented in INM software. Moreover this profiles can be specific to the airport regarding its location in regard to the cities, other airports etc. Present paper shows – regarding the above issues – how important is accurate calibration and validation of an military aircraft noise prediction model. Two step approach to model verification was shown. The first step is calibration by adjustment flight profile parameters and comparing prediction result with measurement for sound exposure levels of a single flight operations. The second step is validation of a model in terms of a long term noise metrics calculated and measured for complex airport traffic. Present study shows errors in noise ranges originating from using standard – instead of real departure/approach profiles. We also shoved influence of calibration measurement points locations on modelling accuracy.

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Computationally Efficient Method for Reconstruction of Sound Speed in Soft Tissues

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Information on the sound speed in the imaged region is needed for correct image reconstruction in ultrasound pulse-echo imaging systems. Such devices are widely used in medical diagnostics due to their non-invasiveness, harmlessness, versatility, time resolution and relatively low cost. However, for the purpose of image reconstruction, these devices use a sound speed value that is an average for soft tissue, which locally can be far from reality and can lead to aberrations. Development of a method for real-time reconstruction of sound speed in tissue will make possible to efficiently correct aberrations in pulse-echo ultrasound imaging. Considering the fact that it is a well established imaging technique, the efficient aberration correction method will definitely contribute to the increase in quality of the diagnostic process. Another motivation for development of sound speed imaging technique is the fact that the sound speed reflects mechanical properties of tissues. Therefore, the calculated sound speed maps may provide additional diagnostic information qualitatively similar to those obtained from elastography. Furthermore, the sound speed data can be used in a more cognitive context in research projects that require non-invasive measurements and where it is not possible to use ultrasound tomography, e.g. study of sound speed in tissues during high intensity focused ultrasound treatment. The most recent scientific reports show that it is possible to qualitatively image the sound speed distribution at low computational costs. However, attempts to transit to a quantitative sound speed imaging required a substantial increase in the computational complexity. This raises doubts concerning the application of the quantitative method in real-time imaging systems.

The method presented in this paper is based on a new mathematical model which allows for computationally more efficient solution while preserving the quantitative character of sound speed imaging. Similarly as in the case of the approaches mentioned above, the input data are low resolution images (LRI) reconstructed for a compounded plane wave imaging (CPWI) sequence. Then, based on phase relations between LRIs, one can calculate the time shifts that are a direct result of the errors in the sound speed value assumed in the image reconstruction process. Next, using the new mathematical model the time shifts are converted to sound speed corrections which finally can be applied to the initial sound speed distribution used in the LRIs reconstruction.

The proposed method was implemented and verified through a number of simulations. The obtained results are comparable to those generated by the reference algorithm – the one described in the mentioned scientific reports. The computational complexity of this new approach is proportional to N while in case of the reference algorithm it is proportional to N^2 (where N is a number of pixels in the calculated sound speed image).

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Ultrasound Attenuation Imaging of Tumor Tissue

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The ultrasound imaging (USG) is one of the most common medical imaging modality. The technique allows for non-invasive and inexpensive visualization of the internal tissue structures. Standard images show the spatial distribution of echogenicity which is related to distribution of