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Linh V Nguyen* (languyen@uidaho.edu). *Some mathematical problems of thermoacoustic tomography.*

Thermoacoustic tomography (TAT) is a hybrid medical imaging modality. A brief pulse of electromagnetic (EM) radiation is scanned through the biological tissue to slightly heat it up. The elastic expansion of the tissue leads to an ultrasound (pressure) wave propagation. The wave is measured by transducers on an observation surface. From this data, one reconstructs the initial pressure distribution, and thus the EM absorption inside the body.

In this talk, we address the following two issues of TAT:

1. Instability: we prove that the reconstruction is not Hölder stable if a natural visibility condition is violated. This complements the results by V. Palamodov (for constant speed) and P. Stefanov and G. Uhlmann (for variable speed), which show that under the visibility condition, the reconstruction is Lipschitz stable.

2. Speed determination in TAT: most of the work done in TAT assumes that the ultrasound speed is known. However, it is usually not known in applications. It is natural to ask whether the TAT data could determine both the ultrasound speed and the initial pressure. We will present some partial answers to this question (joint work with M. Agranovsky and P. Kuchment). (Received August 25, 2011)