STIFFNESS IDENTIFICATION IN BIOLOGICAL TISSUES

Lin Ji[a] and **Joyce McLaughlin**[b]

[a]Department of Mathematics
Rensselaer Polytechnic Institute
Troy, New York 12180
jil@rpi.edu

[b]Department of Mathematics
Rensselaer Polytechnic Institute
Troy, New York 12180
mclauj@rpi.edu

By cross-correlating successive ultrasonic scans of the biological tissue that is excited by a transient source on the surface, recent experiments show that the wave displacement during the interval between the two scans can be measured everywhere in the tissue. Assuming we know the displacement history of the shear wave everywhere, we identify the stiffness change inside the tissue in terms of the Lamé coefficient, μ. Our method starts with the asymptotic expansion of geometrical optics. By tracing the amplitude change of the displacement along the geometrical rays as they travel into the medium, we are able to recover μ without directly taking derivatives of the displacement data.

References

[1] S. Catheline, J-L. Thomas, F. Wu and M. Fink, "Diffraction field of a low frequency vibrator in soft tissues Using Transient Elastography", *IEEE Trans. Ultrason., Ferroelect., Freq. Contr.*, Vol. 46, No. 4, pp. 1013-1019, July 1999.

[2] L. Sandrin, M. Tanter, S. Catheline and M.Fink, "Shear Modulus imaging with 2-D transient elastography", *IEEE Trans. Ultrason., Ferroelect., Freq. Contr.*, Vol. 49, No. 4, pp. 426-435, April 2002.

[3] William F. Walker and Gregg E. Trahey, "A fundamental limit on the performance of correlation based phase correction and flow estimation techniques", *IEEE Trans. Ultrason., Ferroelect., Freq. Contr.*, Vol. 41, No. 5, pp. 644-654, Sept. 1994.