Two-Point Frequency Shift (2P-FS) Method for Shear Wave Attenuation Measurement

Supplementary Material

Piotr Kijanka, *Member, IEEE* and Matthew W. Urban, *Senior Member, IEEE*

THIS document serves as the Supplementary Material for the main manuscript titled *Two-Point Frequency Shift (2P-FS) Method for Shear Wave Attenuation Measurement* by Piotr Kijanka and Matthew W. Urban.

The attenuation coefficient estimates for the 2P-FS method are presented graphically in Fig. S1. These results were computed for numerical phantoms of viscoelastic materials in the presence of white Gaussian noise. The white Gaussian noise was added to the shear wave time-domain particle velocity signals to yield different SNR. First signal position versus the distance between two measurement signals is investigated for the 2P-FS technique. Results for the numerical Models A, B, C, and D, with a SNR of 25, 20, 15, 10, and 5 dB are introduced in the rows counting from top to bottom, respectively. Smooth transition of the data, within selected regions, can be observed. A progressive attenuation change is observed between all numerical models investigated. For lower SNR values higher attenuation variations are present. These changes are more readily visible in Fig. 7, in the main manuscript, where boxplots computed for the attenuation measured within the ROIs in Fig. S1 are shown.

ACKNOWLEDGMENT

The content is solely the responsibility of authors and does not necessarily represent the official views of the National Institute of Diabetes and Digestive and Kidney Diseases or the National Institutes of Health.

This work was supported by grant R01DK092255 from the National Institutes of Health. *(Corresponding authors: Piotr Kijanka and Matthew W. Urban.)*

P. Kijanka is with the Department of Radiology, Mayo Clinic, Rochester, MN 55905 USA, and also with the Department of Robotics and Mechatronics, AGH University of Science and Technology, 30-059 Krakow, Poland (e-mail: piotr.kijanka@agh.edu.pl).

M. W. Urban is with the Department of Radiology, Mayo Clinic, Rochester, MN 55905 USA and also with the Department of Physiology and Biomedical Engineering, Mayo Clinic, Rochester, MN 55905 USA (e-mail: urban.matthew@mayo.edu).

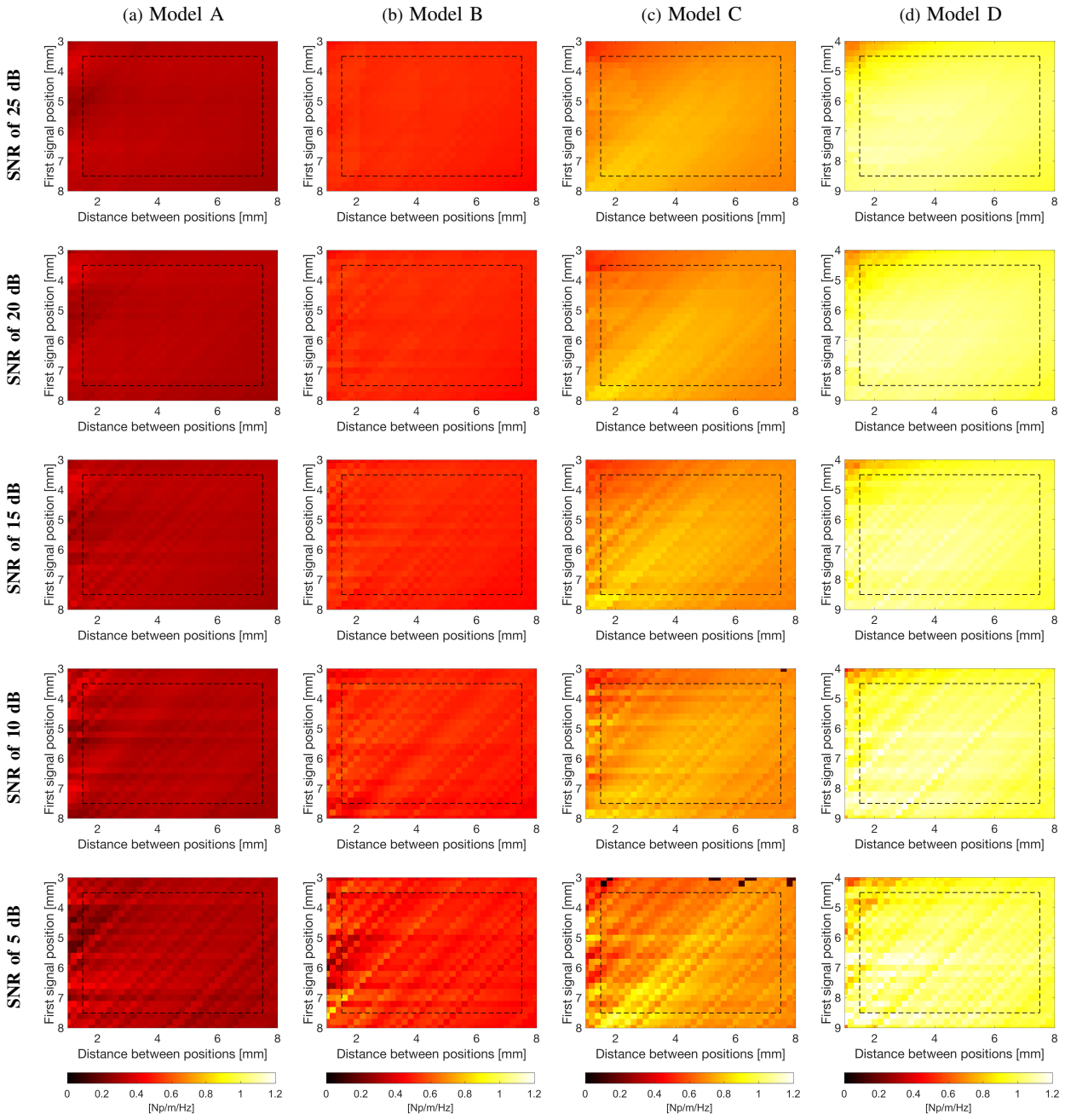

Fig. S1: Attenuation measurements for the 2P-FS method. Results are presented for the numerical LISA viscoelastic phantoms with a SNR of 25, 20, 15, 10, and 5 dB, respectively, with assumed the shear modulus of 3.24 kPa and viscosity of 0.25 Pa·s (Model A), 0.5 Pa·s (Model B), 1 Pa·s (Model C), and 2 Pa·s (Model D), respectively. Results for various first signal positions and distance between two positions are shown.