TITLE: Improving the strain estimation processing speed towards real-time elastography.

1. INTRODUCTION
   1. Introduction to OCE
      1. *Applications and significance*
         1. *E.g. use in real time breast cancer surgery (hence strain estimation, doesn’t require quantitative)*
      2. *Need for processing speed ups*
2. BACKGROUND
   1. Optical coherence tomography
      1. *Time domain v. frequency domain*
      2. *Contrast is optical properties of tissues*
   2. Elastography (general)
      1. *Mechanical properties of tissue*
      2. *Characterized by 3 deciding factors -> underlying imaging technique, method of loading, measurement of displacement/velocity*
   3. Optical coherence elastography
      1. *Description of OCE loading techniques*
         1. *Compression OCE, shear wave, surface acoustic, etc.*
      2. *Methods of measuring displacement*
         1. *Phase sensitive OCE v. speckle tracking/correlation*
   4. Strain estimation
      1. *Reasons for linear displacement fit (linearly elastic assumption)*
      2. *Low pass digital differentiators (and reasons for i.e. removing high frequency noise)*
      3. *Least squares approach (including statistical basis of weights – Goodman phasors)*
      4. *Savitzky-Golay filtering (appendix on coefficient derivation?)*
3. METHODS
   1. Compression OCE system
      1. *Samples, acquisition*
   2. Data (phantom used)
   3. Description of the standard algorithm
      1. *Volume unwrapping*
      2. *Sequential weighted least squares*
      3. *With Savitzky-Golay filtering*
   4. Phase offset method
      1. *With Savitzky-Golay filtering*
   5. Weighted finite difference with Gaussian smoothing
      1. *Including different lateral averaging comparisons*
   6. Performance metrics
      1. *Processing speed (strain only)*
      2. *Sensitivity*
      3. *Image resolution*
4. RESULTS
   1. Image qualitative comparison
      1. FIGURE:
   2. Processing speed comparison
      1. *Per B-scan (strain estimation only – fit length implications)*
      2. *Per C-scan (with and without file I/O overhead)*
      3. *FIGURE: C-scan time for different fit resolutions*
   3. Sensitivity comparison
      1. *Definition, chosen region of sensitivity*
      2. *FIGURE: Plots of this region only for different techniques*
      3. *FIGURE: Sensitivity at different fit resolutions*
   4. Image resolution
      1. *Optimizing the fit of error function over the phantom boundary*
      2. *FIGURE: Example boundary fit & resulting Gaussian*
      3. *FIGURE: Image resolution at different fit resolutions*
5. DISCUSSION
   1. Optimum processing algorithm
   2. Further areas of investigation in strain estimation
   3. Implications for other areas of OCE