AbstractID: 2199 Title: Model-Based Comparison of Two Breast Tissue Compression Methodologies

Many imaging modalities are used clinically in the detection and diagnosis of breast cancer. Registration of images acquired by various modalities or at different times with the same modality is challenging due to differences in breast compression and orientation. Several techniques for image registration have been proposed, but to date there has been no systematic evaluation. We have developed a 3D anthropomorphic breast model which allows simulation of different imaging modalities with variable breast compression. A key component to using a model in breast imaging is compression simulation. We have developed two methods for simulating tissue deformation. The first separately analyzes deformations of tissue layers normal to the compression plates which are approximated by elastic rectangular beams. The second applies a finite elements (FE) model of tissue deformation. FE models can yield highly realistic mechanical models; however, such models are computationally intensive. This research is predicated upon finding realistic, yet computationally efficient methods, of simulating breast compression. Synthetic mammograms with a resolution of 0.2 mm were generated using both compression methods and a previously reported x-ray acquisition model. Generated mammograms have been compared using estimated compression force, and image power spectrum. Preliminary results show that the compression forces estimated by the two methods are approximately equal (168N vs. 178N for a 5cm compressed breast) and within the clinical range. In addition, non-rigid registration of synthetic mammograms generated with various compressed breast thicknesses is ongoing. In summary, a discussion of the impact of compression methodology on image registration will be reported.