AbstractID: 13855 Title: Refinements to the Deformation Model of an Anthropomorphic Computer Generated Breast Phantom

Purpose: We have previously developed a method for generating synthetic mammograms and breast tomosynthesis images of an anthropomorphic computer generated breast phantom. Mammographic compression of the phantom was simulated based upon a finite element (FE) deformation model. Currently, the compressed phantom is affected by artifacts arising during deformation. In this paper we investigate two refinements to the deformation model. **Method and Materials:** The mammographic compression simulation involves three steps. First, the undeformed voxel phantom is transformed into a mesh of tetrahedral elements, with each element encompassing several hundred voxels. Decimation reduces the computational complexity of the finite element model. Second, an FE deformation model is applied resulting in a deformed mesh. Finally, the deformed phantom is voxelized by interpolation. Each voxel in the undeformed and deformed phantoms encode a single tissue type. To reduce deformation artifacts we supersampled the deformed phantom during interpolation; uniformly spaced 3x3x3 sub-voxel sampling points were used for each deformed voxel. In addition, we introduced rules governing the assignment of the tissue type to each voxel in the deformed phantom. Each voxel is now assigned the tissue type most frequently referred to by the supersampling points. These refinements were evaluated by analyzing phantoms whose interior consisted of regularly spaced parallel planes. **Results:** Without supersampling, 33.6% of the undeformed phantom voxels were not used during interpolation; supersampling reduced the number to 0.2%. The refined rules governing the tissue assignment improved the smoothness of the boundaries between simulated tissues; particularly near the interface between the breast phantom and air, where previously voxels incorrectly assigned as air produced noticeable artifacts. **Conclusion:** The refinements of the phantom compression model improve the simulation of tissue structures. This is especially important for the simulation of small structures (*e.g.*, microcalcifications).