Introduction

In the field of preventative breast cancer screening, Digital Image Elasto-Tomography (DIET) is an emerging elastographic method intended for use as a low-cost breast cancer screening test. In the DIET-system, mechanical material parameters are reconstructed solely based on surface motion data that are obtained using digital cameras. Fig. 1 schematically shows the motion capture system, as currently employed for the application on gelatine phantoms.

The motion data obtained is now used in an optimization based inverse algorithm to reconstruct interior parameters, with an appropriate numerical forward solver embedded. Where traditionally Finite Element Methods that require the mesh of the full domain have been employed to solve the governing PDE on the given geometry, this study explores the use of the Boundary Element Method (BEM) that requires a surface mesh only.

Results

Convergence behavior was observed to be good in all reconstruction problems with a small number of iterations required, but with sensitivity to start values when large amounts of noise was added. Fig. 3 shows the typical convergence behavior for any of the inverse problems. Fig. 4 shows results for the reconstruction of Elasticity contrast for different inclusion sizes and noise levels.

Conclusions

The use of the 2D BEM for the reconstruction of elastic parameters in the DIET-system has shown promising results. Elasticity information has been determined accurately and with fast convergence. Also, in the presence of low noise levels, acceptable results were achieved. Future work will focus on the extension of the method to a full 3D application and experimental testing on gelatine phantoms.