AbstractID: 1565 Title: Numerical Estimation of Material Property for Lung Tissue

Image based deformable organ registration can be performed using the Finite Element Method (FEM) with the boundary condition of organ segments. However, the accuracy of FEM calculation depends on the strain-stress relationship with the parameters of tissue elasticity, and reliable values of these parameters for living tissues are most unlikely accessible during the treatment. To overcome this problem in the study of image-based deformable organ registration, a noninvasive method was developed to best estimate the tissue properties for individual patient in the lung cancer treatment. Following a 4D CT imaging, positions of landmarks (locations of vascular and bronchial bifurcations) in different respiration phases are utilized to form an optimal estimation problem for tissue elastic parameters. Because healthy lung part and solid tumor obviously have different mechanical responses, different strain-stress relationships are applied for them. An initial pressure was introduced to mimic the pulmonary pressure during normal respiration. The elastic properties for lung and tumor were optimized to minimize the difference of the calculated and measured landmark positions manifested on CT image of 2 breathing phases. Validations were then performed by investigate the positions of the same landmarks in other respiration phases.

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