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Faithful haptic feedback in medical simulators

Abstract

A method for real time simulation and interaction of deformable objects in medical simulators is proposed. We are interested in applications for training surgeons using haptic interaction. For haptic purposes, our medical simulator is based on a dual model architecture; simulation and haptics. We currently use a new physical model LEM - Long Element Method as the simulation model. We find that this model can produce satisfactory global changes for small and large deformations. In this paper, we will focus on implementing an haptic interaction method with stable and realistic force feedback designed for use with LEM. A deformable buffer model is used to solve problems arising from the difference between sampling and update rates. We look into the construction and the updating process of this buffer model. Our approach to linking the two models to get realistic force feedback is also presented. The physical and haptic model are then coupled to be part of a surgical simulator for soft tissue. We present some results from our prototype medical simulator for echography exams of the human thigh.

Keywords — Medical simulators, haptic interaction, physical models, deformable objects