Towards a realistic medical simulator using virtual environments and haptic interaction

Abstract

This paper presents our experience towards the conception of a virtual reality medical simulator coupled with haptic interaction aimed at training surgeons. This area of research has a long history and a wide variety of approaches have been used. Generally, human tissue can be considered as a deformable body of viscoelastic material. To enable dynamic simulation of these bodies, we have patched three well known physical models onto their geometrical model: mass-spring networks which is more of a discrete object model, finite element method (FEM) based on continuum mechanics and recently long element method (LEM) which we believe to be more promising. We make some comparisons between these models. We also present some numerical resolution method for simulation of deformable bodies. As far as real-time interactions are concerned, we present our work on collision detection, haptic interaction and topology modifications. In the haptic system, we separate the physical simulation and the haptic interaction to ensure stability; the link between the two process is acheived by means of a local model which will be eloborated. We present some experimental results to highlight these works.