The Soft Tissue Implementation with Triangulated Mesh for Virtual Surgery System

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Abstract. In this paper, we describe specific issues arising during implementation of the virtual surgery simulator. Virtual surgery simulator is a software that provides realistic surgery experience using virtual reality technologies. We discuss the necessary requirements that a virtual surgery simulator shall meet, and suggest the possible solutions for its implementation, such as triangulated mesh for realistic rendering of soft tissue and haptic feedback. Among the supported operations with our solution for soft tissue there are cutting and stitching. Fluid dynamics are also mentioned.

Keywords: Real-time visualization · Virtual surgery · Computer simulation · Biological development · Biological dynamics · Brain

1 Introduction

The virtual surgery system was created in SIM openlab of Kazan Federal University [3]. As the presence of virtual reality in our daily lives increases, the educational system – from the kindergarten and all the way to the college – must respond to this new challenge. Naturally, medical surgical education is one of the top candidates for virtual reality technologies use, as it can save many reagents and laboratory supplies, and, as such, reduce overall monetary spending [4]. This comes with a price of possible lack of proper experience with real-life operations and reduced realism of the simulation, which in the surgery case can be downright lethal. We can, therefore, conclude that the field of virtual surgery has requirements much stricter than any other application of VR. What are those restrictions exactly?

- Highly-quality graphics, which can give the operating person a good idea of how the real thing looks;
- Realistic physics of human tissues and fluids, their proper response to various surgical procedures;
- Haptic and force feedback for user's hands according to situations in all processes;
- High level of user immersion.

As said it might be to admit, none of currently existing virtual surgery solutions are capable of matching these criteria. This leads us to the point of this paper: we propose a