

## 25th Umbrella Symposium

For the development of Joint Cooperation Ideas  
“Modeling and Simulation with emphasis on high  
performance computing and grid computing”

Virtual Reality for Hands-on Medical Training

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### Abstract

Training simulators get increasing importance in medical education to provide valuable hands-on practice. In this talk we will present our ongoing work in the area of virtual reality based medical training.

A first application of our research is in regional anesthesia procedures, which encompass needle intervention and palpation. Our developed simulator allows the expert or trainee to directly control a virtual hand for palpation and a needle in a bimanual setup. Employing force-feedback devices, the virtual patient’s simulated soft-tissue can be deformed and the user feels its resistance, subcutaneous structures and pulse. Recently, ultrasonography is receiving increasing importance as a supporting imaging technique for this procedure. Therefore, our current research comprises the interactive simulation of ultrasound with the goal to combine it with the already developed techniques.

Another application of our research is in bilateral sagittal split osteotomy, a procedure combining the sawing and breaking of the underjaw to enable the correction of jaw malpositions. In our currently developed training simulator, we apply the extended finite element method, which is well suited for simulation of breaking materials and combine it with a multiple contact-points haptic simulation with six degrees-of-freedom force output. Being developed in interdisciplinary research projects, our simulators are continuously evaluated with medical experts.