A haptic rendering technique based on hybrid surface representation

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We introduce a haptic rendering technique based on a hybrid surface representation - a combination of a geometric and an implicit surface model. Using this approach, we address conventional limitations in haptic displays by achieving fast and constant force update at 1 kHz independent of the size of geometric models, accurate and stable simulation of surface properties like friction, stiffness, and haptic texture, and avoiding force discontinuity. In addition, we present a haptic decoration and sculpting techniques. Haptic decoration allows the user to paint directly on the 3D model (haptic painting) and sense the surface variation on the painted image (image-based haptic texturing). Haptic sculpting enable the user intuitively to adds to and carves out material from a volumetric model using virtual sculpting tools. The volumetric model being sculpted is converted into the geometric model for visualization. The resultant geometric model is adaptively polygonized according to the surface complexity. Based on this haptic rendering technique, we have implemented some applications including haptic collaboration, haptic vector field sim ulation, and a haptic dental training system.

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Research Interests

Haptic interface, VR/Computer Graphics, HCI, Wearable computer

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