

A Hand Rehabilitation Computer System Using Commercial Haptic Device

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摘要

Abstract

This paper describes a PC based hand rehabilitation system equipped with a commercial haptic device. The proposed system uses a 3D hierarchical hand model to describe the transformation between the wrist with any MCP joint, and the transformations between an MCP or PIP joint with a PIP or DIP joint on the same finger. Through this hand model, a 3D hand image with dynamic rotation of any joint can be demonstrated in real-time. The system also uses the 6D input of the haptic device and the accumulation of transformation matrices between the related joints to estimate the rotational angle of the rehabilitated joint. The system can detect the force and the range of joint motion in the active rehabilitation by the estimated angle and the 3D output force of the haptic device. The detected force and the range of motion are then used to control and achieve high efficient passive rehabilitation. A rehabilitation example of the PIP joint of the index finger demonstrates the attachment, set-up of the haptic device to the rehabilitated joint and shows the rehabilitation can be improved by the controlled passive rehabilitation.

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Controlled terms: Computer systems - Dynamic models - End effectors - Estimation - Image storage tubes - Mathematical transformations - Three dimensional

Uncontrolled terms: Active rehabilitation (ACRE) - Dynamic rotation - Hand modeling - Haptic devices - joint motions - National Taiwan University (NTU) - output force - range of motion (ROM) - Rehabilitation (Construction) - rehabilitation systems - Rotational angles - Transformation matrices

Classification Code: 921.3 Mathematical Transformations - 921 Mathematics - 731.5 Robotics - 723.5 Computer Applications - 722 Computer Systems and Equipment - 714.1 Electron Tubes - 461.5 Rehabilitation Engineering and Assistive Technology