

博士论坛

基于脑机接口的智能康复系统的设计

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摘要 为了辅助脊髓损伤所导致的瘫痪病人的运动功能重建,将脑机接口技术和功能性电刺激技术相结合,开发了一种可供瘫痪病人根据自己的运动意愿控制残肢运动的智能康复系统。该系统能够绕过患者体内受损的神经通路,直接将人的运动意图通过外部通路传达给功能性电刺激仪,刺激相应的神经肌肉,完成患者对残肢的直接控制。详细介绍了该系统的总体设计思路、脑机接口实验设计、特征提取与分类算法、功能性电刺激仪的设计等关键技术。初步实验表明,本康复系统能以95%以上正确率分析人的运动意图,控制功能性电刺激仪完成预定的刺激任务,恢复手部抓握动作,展现出巨大的实用价值。

关键词 [脑机接口](#) [脑电](#) [拉普拉斯电极](#) [功能性电刺激](#) [运动康复](#)

分类号

Design of intelligent rehabilitation system based on Brain-Computer Interface

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Abstract

In order to assist motor rehabilitation of patient with tetraplegia caused by Spinal Cord Injury (SCI), the method of combination Brain-Computer Interface (BCI) with Functional Electrical Stimulation (FES) is proposed and the intelligent rehabilitation system is designed, which can help the patient control their paralyzed extremity by thought. The system can bypass the injured spinal cord in the body, and transmit the motor intention to FES instrument directly through external channel. Then the FES instrument stimulates the corresponding muscles to assist patient performing the movement. The key technologies are introduced, which consist of the architecture of the system, the design of BCI experiment, the algorithms of feature extraction and classification, and the design of FES instrument. The preparatory experiments show that this rehabilitation-assisting system can comprehend the patient's motor intention by the accurate rate above 95% and restore the hand grasp function by FES device, which reveals great value in clinical rehabilitation.

Key words [Brain-Computer Interface \(BCI\)](#) [electroencephalograph \(EEG\)](#) [Laplacian electrode](#) [Functional Electrical Stimulation \(FES\)](#) [motor rehabilitation](#)

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