



## 论文摘要

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## 基于位置内环的骨骼服力控制方法

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**摘要:** 讨论一种基于位置内环的力控制方法, 并将其应用于骨骼服的控制之中。首先, 基于系统的静态模型建立骨骼服的位置控制内环, 再采用多维力/力矩传感器测量操作空间中人作用于骨骼服的力/力矩信息, 构造位置内环的参考输入信号, 形成力控制外环, 并对人体负荷情况下的蹲起动作进行仿真实验。研究表明: 该方法无需系统精确的动态模型, 就能控制骨骼服跟随人体运动, 并保持人体对骨骼服的作用力最小; 所设计的控制器是有效的, 并对环境变化和负荷变化具有较强的鲁棒性。

**关键字:** 骨骼服; 力控制; 人机结合; 位置内环

## Exoskeleton suit's force control method based on inner position loop

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**Abstract:** A force control method based on inner position loop was discussed and applied to the control of exoskeleton suit. The inner position control loop based on the system's static model was built first. Then the multidimensional force/torque sensor was used to measure the interaction force/torque between the pilot and the exoskeleton suit in the task space. The reference input signal of the inner position loop was constructed by the force signal and the outer force control loop formed. Simulation of crouching and getting up action with heavy load was made. The results show that the method can control the exoskeleton suit following the pilot's motion and minimizing the interaction force without the exact dynamic model of the exoskeleton suit. The designed controller is valid and feasible. The controller is robust to the variation of the environment and the load.

**Key words:** exoskeleton suit; force control; human-machine combination; inner position loop

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