Mechanical Engineering Thesis Defense

Quantification of shoulder stiffness at various arm postures using a 4-bar parallel exoskeleton robot

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Abstract

The shoulder joint's intricate structure allows a wide range of motions to complete tasks, ranging from simple daily activities to more complex activities such as car manufacturing.• This wide range of motion is upheld by the shoulder joint's inherent stability, maintained by a careful interplay of its intrinsic structures, including bones, ligaments, and tendons, coupled with muscle contraction. Understanding the mechanical characteristics of the shoulder joint holds significant importance, as it provides the fundamental mechanisms that ensure shoulder joint stability. Joint stiffness is a significant factor in stability as our maintaining posture and movements behave like a spring. Characterizing the stiffness of an intact shoulder joint can provide significant baseline data, which can then be effectively used to customize rehabilitation protocols for individuals with neuromuscular impairments.• Furthermore, this data can be beneficially harnessed in developing robotic controllers, including robotic impedance controllers, to enhance transparency and guarantee safe interaction between robots and user counterparts.

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