FlexiSpine: An Adaptive Robotic Brace for Personalized Spinal Deformity Treatment

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Spinal deformity is usually a symptom cause by scoliosis. The current method of treating such disease is through a brace that fits around torso and hip to force the spine to display the normal curvature. The traditional bracing imposes several limitations due to their rigid, static, and sensor-less designs and inability to adapt to changes in the skeletal system in accordance with treatment. Forces and moments exerted by the brace cannot be measured or modulated, and the three-dimensional stiffness of the human torso has not been characterized, which are all crucial factors to be considered in bracing treatment. In the recent years, the concept of robotic spine exoskeleton is introduced to improve on the conventional bracing. This paper described the building of mechanical and control architectures for an active Thora-columbo-sacral orthosis for the correction of spinal deformities including scoliosis, kyphosis, and lordosis. The exoskeleton is composed of two Stewart-Gough platforms in series, each controlled independently the position. The position and the motion of the different region of spine could be controlled through each platform utilizing the six linear actuators. An AI agent is applied to analyze the severity of the deformities and perform recommended treatment that change correspond to the skeletal system. Index Terms—Human torso stiffness, spine deformity, robotic spine brace, exoskeleton, AI