

Dampace: A Energy-Dispersing Exoskeleton For Rehabilitation Research, Assessment And Training

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To facilitate force-coordination training of upper extremities of stroke patients, a controlled energy-dispersing exoskeleton has been developed, called the Dampace. The exoskeleton applies resistive torques of up to 50Nm (resolution: 0.25Nm, bandwidth: 5Hz) around each of the three and one rotation axes of the shoulder and elbow, and allows unrestricted forearm pro-and supination and shoulder translations. As the resistance is applied via pure torques, alignment of the exoskeleton axes to the arm axes is not required, minimising setup times. And though maximum possible torques are high, the exoskeleton only dissipates energy, making it inherently safe.



The Dampace measures the rotation angles of and resistive torques around the four controlled axes in real time. The applied torques can be made dependent on the arm movements, using a range of virtual force profiles. For example, during repetitive elbow rotations, the torques could be higher for flexion than extension. Or it might be used as a iso-kinetic dynamo- or iso-metric torque metre. All measurements are available for graphical feedback on a monitor, for instance by plotting an arm on a display, manipulating virtual objects.

Though there are many other upper extremity exoskeletons, the Dampace is unique because its inherent safety, can apply large resistive torques with a high resolution on any combination of axes, with very low setup times. This makes the device both useful for research as well as assessment and training.