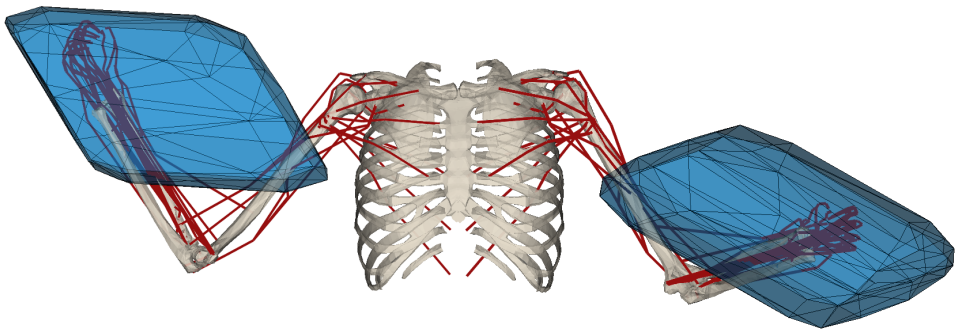

Efficient calculation of human wrench or force capacity based on human musculoskeletal models

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In this presentation, evaluating the physical ability of humans, based on the musculoskeletal models, will be discussed. More precisely, one of the most important physical ability metrics, human's wrench capacity: *"the ability to generate and resist forces and moments in arbitrary directions in space"*.

Wrench capacity metrics are well known tools for evaluation and analysis of the performance of robotic manipulators. Arguably, the most widely used capacity metrics are manipulability ellipsoids, the approximations of the true capabilities which have the form of polytopes. Ellipsoids and polytopes both express the robot's ability to move and apply forces and torques in arbitrary directions. Even though these metrics have been developed for robotics systems, they have been used for human upper limb (arm) analysis as well, in particular for rehabilitation and sports. However, since human bodies are much more complex than robotic systems the wrench capacity calculation is not efficient and in many cases not practical to use, as for more complete human body models (50+ muscles), standard methods can take several hours to evaluate.

Finally, our recent work on the efficient wrench capacity polytope evaluation will be presented, enabling the real-time calculation of a human's physical ability. The real-time capability of the approach shows the potential to be used for enhancing human-robot interaction safety and performance.