Title (tentative): Physical Simulations of Human Grasping

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Description

Motivation and application domain
The apparent ease with which we grasp objects every day masks the complexity of neural computations underlying human grasp planning. The planning of stable grasps is also a highly active and largely unsolved topic in robotics research. The proposed thesis project will focus on developing fundamental tools to understand how humans and machines may plan and execute grasps to manipulate arbitrary objects.

General objectives and main activities
To plan a successful grasp towards an object one must first identify all physically possible and stable grasp configurations. Then, only a subset of these physically possible grasps is likely to be selected given the physical constraints and degrees of freedom of the human actuator (i.e. the hand/arm). To understand how humans identify the space of physically possible grasps, we must first define the ground truth, which requires detailed physical simulations. The thesis project will thus focus on building a physics simulator that attempts to execute grasps on arbitrary 3D objects. The simulator will take 3D mesh models of the objects as input and systematically test all potential grasps to pick up the object with a model human hand. The analysis of these simulations will lay the ground work for a data- and theory-driven approach to understand human grasping and translate human grasping behavior onto anthropometric robotics platforms.

Training Objectives (technical/analytical tools, experimental methodologies)
The student will learn to use existing robotics physics simulators, such as SynGrasp (a MATLAB toolbox for synthesizing and analyzing robotic and human grasps) and Bullet (an open source physics engine capable of simulating collision detection as well as soft and rigid body dynamics).

Place(s) where the thesis work will be carried out: DIBRIS - Valletta Puggia Via Dodecaneso 35

Maximum number of students: 2