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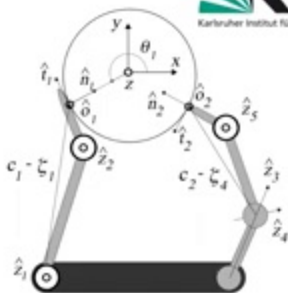
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- **Q4:** Since the MMM framework is about standardization of data formats – has MMM been used by other research institutions?
- The MMM framework is developed at KIT and used by many researchers around the world as its database includes the largest open-source Whole-Body-Motion dataset
 - Right now, there are ~750 non-KIT users registered to the Database

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What Is a Grasp?

- A system wherein a desired object is gripped by the fingers of a robot (or human) hand is generally called a **grasp**
- **Precision grasp:** object gripped by fingertips only
- **Grasp = Set of contact points**
- **Force-closure grasp:** is a grasp which is able to
 1. generate any external force that the grasped object may have to exert on an external body and
 2. counteract any external disturbing forces that may try to loosen the grip



Prattichizzo and Trinkle. *Handbook of Robotics*. Chapter 28, Springer, 2016



- Each point contact can be modelled as either
 - **Frictionless point contact:** Finger can only exert a force along the common normal at the point of contact
 - **Frictional point contact:** A contact that can transmit both a normal and tangential force
 - **Soft contact:** Allows the finger to exert a pure torsional moment about the common normal at the point of contact
- See Lecture Robotics I



Object Classes for Robot Grasping

- **Known objects** (This is the domain of Grasp Planning!)
 - Known object geometry (i.e. we have a complete geometric object model)
 - Approach: Use various grasp planning methods (only for known objects!)
 - **Hard**
- **“Familiar” objects**
 - Class of object is known (e.g. “bottle”)
 - Approach: Reuse grasp knowledge from known class members for new object
 - **Harder**
- **Unknown objects**
 - No knowledge of the object
 - Challenges: Dealing with (incomplete) sensor data (stereo vision, RGB-D, laser scan, haptic data...), segmentation from the background, building a (partial) object model
 - Ideas: Multi sensor fusion, pushing the object, ...
 - **Hardest!**



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