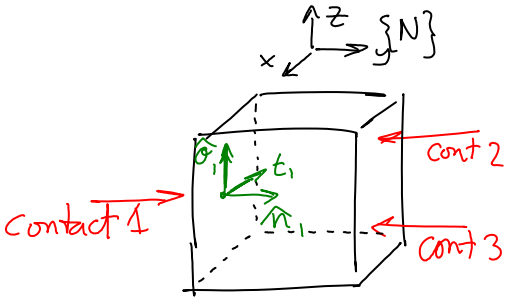
Soln grsp-1

Thursday, January 29, 2009
7:44 PM

For cube on right



Given:

$$\hat{n}_1^N = \begin{bmatrix} 0 \\ 1 \\ 0 \end{bmatrix} \quad \hat{t}_1^N = \begin{bmatrix} -1 \\ 0 \\ 0 \end{bmatrix}$$

$$\hat{n}_2 = \hat{n}_3 = \begin{bmatrix} 0 \\ -1 \\ 0 \end{bmatrix} \quad \hat{t}_2 = \hat{t}_3 = \begin{bmatrix} 1 \\ 0 \\ 0 \end{bmatrix}$$

Provided Matlab code maybe helpful.

(A) Determine $G \Rightarrow$ the contacts could apply any $g \in \mathbb{R}^6$ and could move to cause any $v \in \mathbb{R}^6$

Need to choose contact models to determine G.
Then check rank(G) = 6.

see Matlab code grasping_hw_cube_solns.m

(B) Design simple fingers $\Rightarrow$ the hand (with contacts determined in (A)) can command any $g \in \mathbb{R}^6$ and $v \in \mathbb{R}^6$

I chose 3 fingers each with 3 mutually orthogonal prismatic joints.

(C) Does the grasp have form closure? Why or why not?

No. There are not enough contacts. Need 7 or

more. Also, all contacts are on parallel faces.

(D) Does the grasp have frictional form closure?
Find finger locations and small $\mu > 0$
$\Rightarrow$ friction form closure does not exist.

See matlab code

(E) Does the grasp have force closure?
What changes could you make to the system so that your answer would be reversed?

See matlab code. The answer depends on the contact positions, the friction coefficients, and the friction cone linearization.