**DH parameters:**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| i | 𝛂 i - 1 | a i -1 | d i | Θi |
| 1 | 0 | 0 | 0 | Θ1 |
| 2 | 0 | L1 | 0 | 90o + Θ2 |
| 3 | 0 | L2 | 0 | Θ3 |
| 4(E) | 0 | L3 | 0 | 0 |

**Gravity vector:**

𝝉m1 = | l1 cos Θ1g m1 |

| 0 |

| 0 |

𝝉m2 = | (l1 cos Θ1+ r2 cos Θ1,2)gm2, |  
 | l2 cos Θ1,2gm2 || 0 |

𝝉m3 = | (l1 cos Θ1+ l2 cos Θ1,2+ r3cos Θ1,2,3)gm3, |  
 | (l2 cos Θ1,2+ l3 cos Θ1,2,3)gm3, ||l3 cos Θ1,2,3gm3 |

𝝉g = 𝝉m1+ 𝝉m2 + 𝝉m3

**controller gains:**

*njgoto*

for q0 and qd0 kp values of **300, 350 and 350** are optimal

for q1 and qd1 **250, 100 and 150**

*njmove*

**300, 180 and 10**

High gains cause oscillation.

The last joint needs very small torque, even with that there is oscillation.

The first and second joints are more proportional to each other, however if any of the three gains is “overtorqued”, all three of them are affected.

Our observation is that the different behaviour of each link is correlated to the length of the given link, and its actual distance from the base.

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Student Name | A(1) | A(2) | B(1) | B(2) | B(3) | B(4) | B(5) | B(6) | B(7) |
| Ke Zhou |  |  |  |  |  |  |  |  |  |
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