Admittance Controller

Advanced Robotics Assignment

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# Gain selection

Given a **second order system** on the form

the **poles** that characterize the system behavior are parameterized in terms of the **damping ratio** , and **natural frequency** , where

For a **critically damped system**, the poles must be on the real axis, such that

To select the **impedance parameters**, some choices must be made; for example, the **stiffness** can be defined in terms of the maximum desired displacement in **steady state** for a given force , as

Then, given some desired mass , the damping can be computed as

# Implementation

The moment in desired frame is computed from the wrench as

where

is the adjoint matrix for some transformation , and denotes the skew-matrix operator.

## Quaternion-based controller

Given a unit quaternion

for some orientation of angle around a unit vector . Furthermore, (normalized).

The angular velocity must be integrated into a unit quaternion, as

where denotes a quaternion product, and is defined as

Given a unit quaternion , the (orientational) compliant frame is obtained as

Given that , then . Likewise, for a quaternion

## Euler-based controller

Text.

Definiton of euler angles used

T matrix (optional: and why)

Integration of Euler angles (pleb method)

Compliant frame from phi\_cd