

Cubli: Dynamic Control of a Reaction Wheel Inverted Pendulum

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Agenda

Cubli: Dynamic Control
of a Reaction Wheel
Inverted Pendulum

Stability Analysis

Classical Controller
Design

Stability Analysis

Classical Controller Design

Stability Analysis

Root Locus

Cubli: Dynamic Control
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Inverted Pendulum

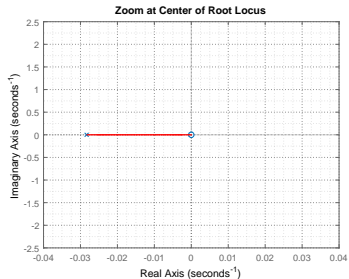
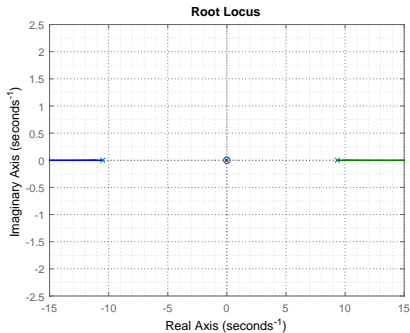
Stability Analysis

Root Locus

Nyquist Plot

Classical Controller
Design

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Stability Analysis

Nyquist Plot

Cubli: Dynamic Control
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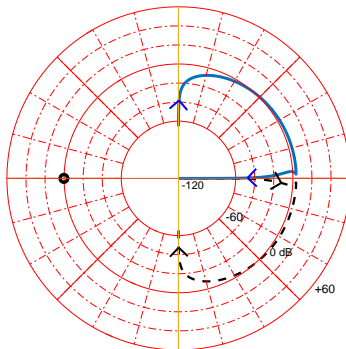
Stability Analysis

Root Locus

Nyquist Plot

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Classical Controller
Design



Classical Controller Design

SISO Block Diagram

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SISO Block Diagram

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Final Controller

Discretization



$U(s)$ refers to the desired angular position of the frame

$Y(s)$ refers to the actual angular position of the frame

Classical Controller Design

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Stability Analysis

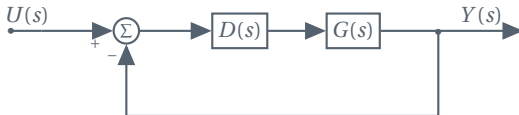
Classical Controller
Design

SISO Block Diagram

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Final Controller

Discretization



Root Locus Designed Controller

Final Root Locus

Cubli: Dynamic Control
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Stability Analysis

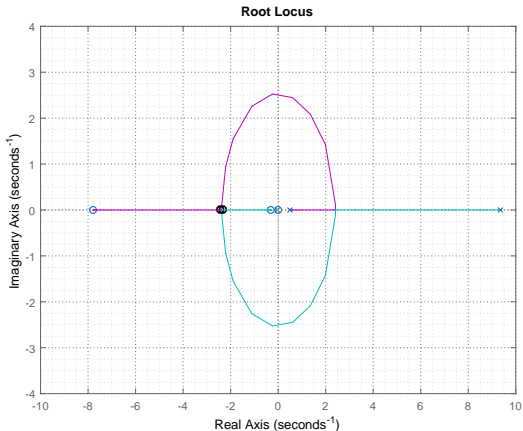
Classical Controller
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SISO Block Diagram

Final Controller

Discretization

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Root Locus Designed Controller

Final Root Locus

Cubli: Dynamic Control
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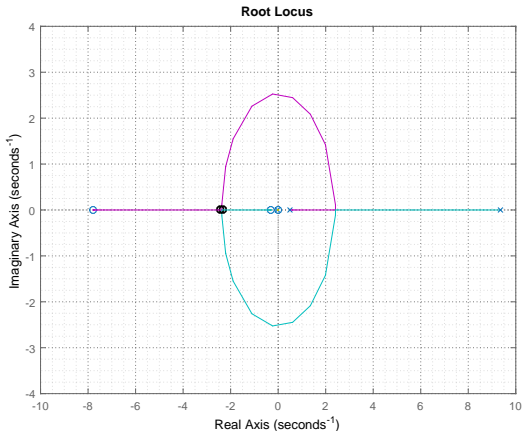
Classical Controller
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SISO Block Diagram

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$$D(s) = -4582,2 \cdot \frac{(s + 9,488) \cdot (s + 1,599)}{(s - 5,54) \cdot (s + 100) \cdot (s + 200)}$$

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Root Locus Designed Controller

Discretization

Cubli: Dynamic Control
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Stability Analysis

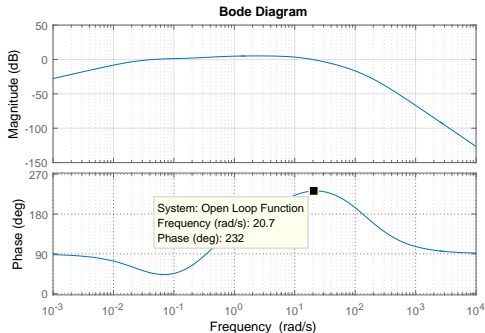
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$$D(z) = \frac{\tau_{m,w}(z)}{e_\theta(z)} = \frac{-8,314 + 7,422 \cdot z^{-1} + 8,302 \cdot z^{-2} - 7,434 \cdot z^{-3}}{1 - 1,382 \cdot z^{-1} + 0,3415 \cdot z^{-2} + 0,001638 \cdot z^{-3}}$$

Root Locus Designed Controller

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