Steering angle as a P feedback controller on roll rate

Conclusion :

* **The controller with only P feedback on roll rate is unstable**
* **It is possible to find a stable controller but with positive feedback, which would amplify disturbances**

Dynamic equation describing the bike :

The inertias and can be written as :

The equation describing the bike becomes :

Using a P feedback on roll rate :

In state-space form :

The closed-loop system is stable iif . To find the eigenvalues of , we have to solve for in :

Discriminant of () :

As , and the eigenvalues of the system are given by :

For the system to be stable, we need and . As is always negative, we have to find the conditions under which is negative :

Steering angle as a PD feedback controller on roll rate

Conclusion :

* **aaa**

Dynamic equation describing the bike :

Using a PD feedback on roll rate :

In state-space form :

The closed-loop system is stable iif . To find the eigenvalues of , we have to solve for in :

Steering rate as a PD feedback controller on roll rate

Conclusion :

* **aaa**

Dynamic equation describing the bike :

Using a PD feedback on roll rate :

In state-space form :

The closed-loop system is stable iif . To find the eigenvalues of , we have to solve for in :

As is always negative, we check under which conditions is negative. We have two separate cases :

As , we need