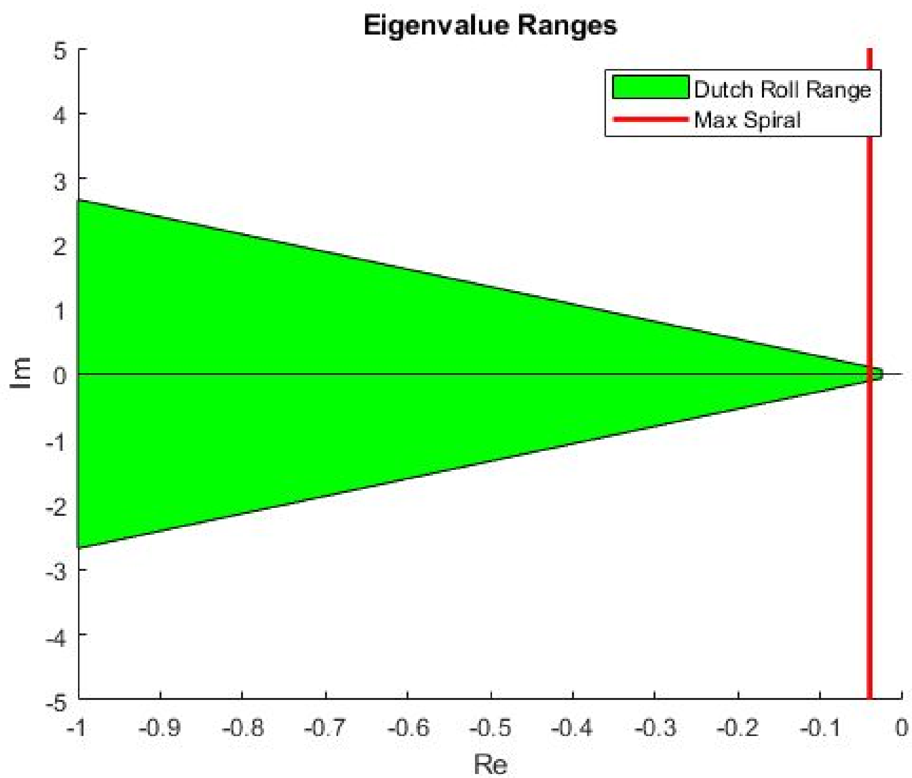
Samuel Rauzmovksiy
ASEN 3128 Assignment 12
12/12/2019

K =

0	0	0	0	0	0
0	0	1.55	0	0	0

1. a)



λ = n ± σi

n = -1/τ,

$\omega = (n^2+\sigma^2)^{½}$

ω = -n/ζ

Substituting ω

$(n^2+\sigma^2)^{½} = -n/\zeta$

Solving for imaginary poriton

$\sigma = (n^2/\zeta^2-n^2)^{½}$

Dutch Roll:

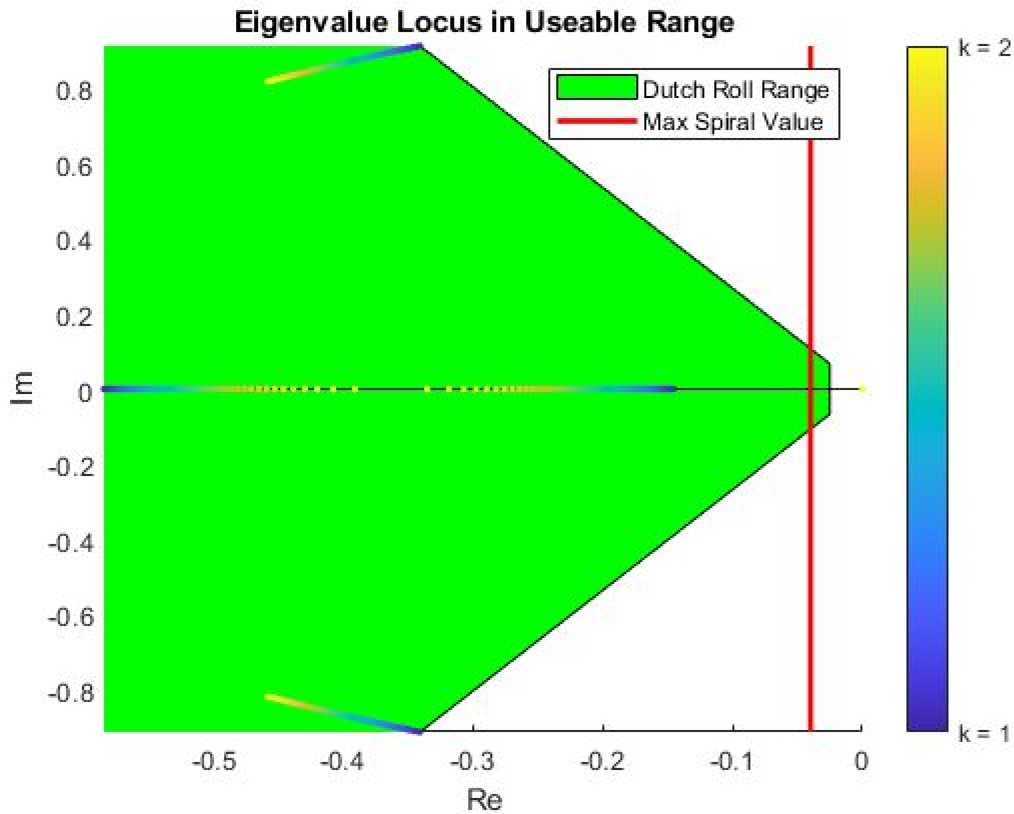
n < -1/40

$n < -0.025$

$\sigma < (n^2/0.35^2 - n^2)^{1/2}$

Spiral:

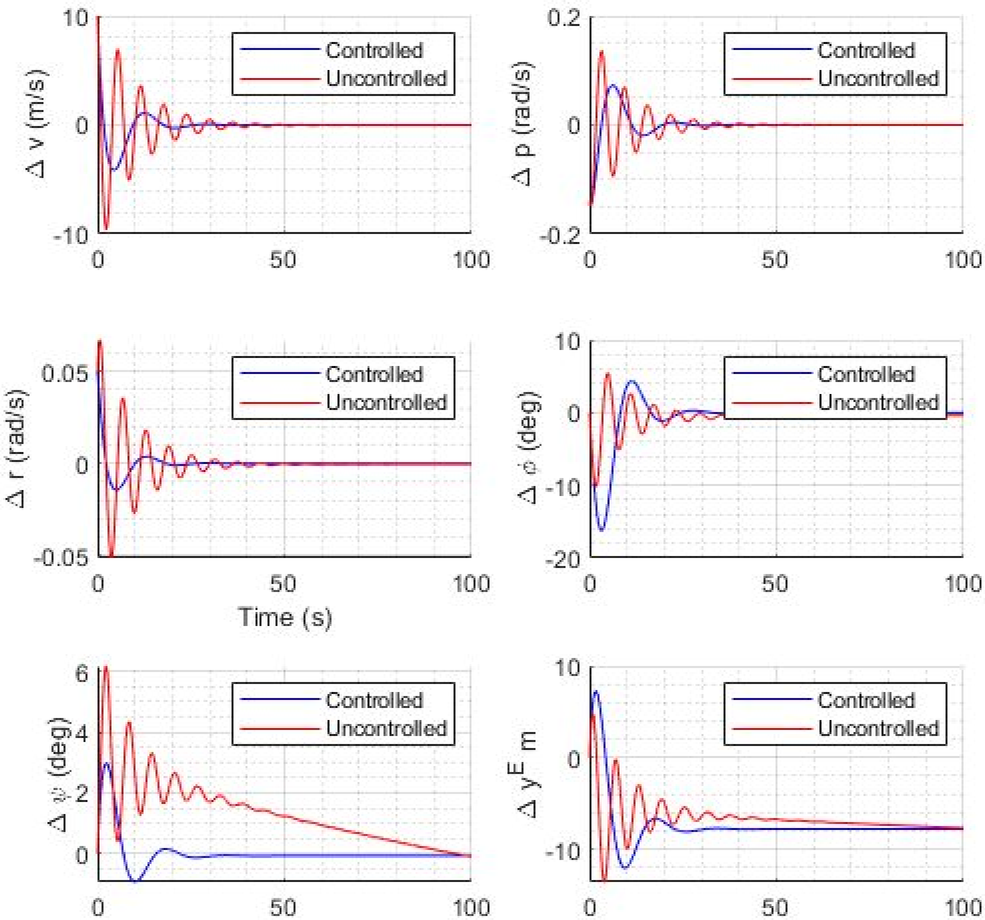
$n < -1/25$



b) The controller I designed only has a K_{rr} value and it seems to do enough to properly stabilize the aircraft with the requirements given. The stability derivatives that are mostly affected are $\mathcal{Y}_r$, $\mathcal{L}_r$, and $\mathcal{N}_r$. The value I chose brings the spiral and roll modes extremely close together while also dampening the dutch roll mode. This may not be optimal since there can be deviations and a new mode can suddenly appear with a slight change in the aircraft's configuration. I came to this choice from the plot provided above.

c) The characteristics of the aircraft to deviations are shown in the plots below. It can be noted that the maximum overshoot in Δv is less than 6 m/s, and the maximum overshoot in $\Delta\psi$ is no where near 5 deg, there is also a maximum peak deflection in the rudder response of 4.44 degrees. Also, there is no aileron deflection since there is no aileron control.

Problem 1.C



Δ v (m/s)
Δ p (rad/s)
Δ r (rad/s)
Δ φ (deg)
Δ ψ (deg)
Δ y^E m
Time (s)
Controlled
Uncontrolled
10
0
-10
0.2
-0.2
0.05
-0.05
-20
6
4
2
50
100