

Setting $s=0$ in a TF
for sinsodial inplet to TF

$$
G_{r f}=\left.\frac{r}{\delta_{f}}\right|_{s=0}=\frac{u}{(a+b)+\frac{\left(\bar{m}\left(b c_{r}-a a_{f}\right) u^{2}\right.}{(a+b) c_{f} c_{r}}}
$$

$$
A \xrightarrow{A \sin \nu t} \xrightarrow{\frac{r(s)}{\delta_{r}(s)}} B \sin (t t+\phi)
$$

$K>0$ understeer stable

$$
\frac{B}{A} \quad \text { mono of } \quad \text { mogrituls }
$$

$$
\phi \quad \text { delay in } \text { rasponse }^{\pi}
$$

$K=0 \quad$ recutral steer stubh
$K<0$ oversteer stable upto $u_{\text {crit }}$
$s=0$ "zero frequang gains"

$$
\begin{array}{ll}
G_{r f}=\frac{U}{(a a b)+K u^{2}} & G_{r r}=\frac{-U}{(a+b)+K U^{2}} \\
G_{a f}=\frac{U^{2}}{(a+b)+K U^{2}} & G_{a r}=\frac{-U^{2}}{(a+b)+K U^{2}}
\end{array}
$$

Standy Cormenis


$$
\underbrace{\alpha_{f}=\frac{V+a r}{u}-\delta \quad \alpha_{r}=\frac{V-b_{r}}{u}}
$$

if $R \gg a+b$ the $\frac{P}{U} \approx R$

$$
S=-\alpha_{f}+\alpha_{r}+(a+b) R
$$

$L$ functions of $U$ and $V$
$\delta=(a+b) R$ for very slow speeds
Steady turning $\dot{r}=\dot{V}=0, \quad r=\frac{U}{R}$

$$
\begin{aligned}
& \frac{m u^{2}}{R}=Y_{f}+Y_{r} \\
& I r_{r}^{0}=a Y_{f}-b Y_{r} \\
& \delta=-\alpha_{f}+\alpha_{r}+\frac{(a+b)}{R} \\
& \delta=\frac{Y_{f}}{}=\frac{m u^{2} b}{R(a+b)} \\
& V_{r}=\frac{m u^{2} a}{R(a+b)} \\
& \delta=\frac{Y_{f}}{c_{f}}-\frac{Y_{r}}{c_{r}} \frac{(a+b)}{R}
\end{aligned}
$$

$$
\begin{aligned}
& \delta=\underbrace{(a+b) C_{f} c_{r}}_{K}, \frac{m\left(b c_{r}-a c_{f}\right)}{R}+\frac{u^{2}}{R} \\
& \delta=\frac{K u^{2}}{R}+\frac{\frac{a+b}{R}}{\operatorname{Ligh}_{\text {sositua }}^{R}} \\
& \begin{array}{l}
\text { chan } \\
\text { Charge }
\end{array}
\end{aligned}
$$

$K>0$ under, stable
$K=0$ neutral, stable
$K<0$ over, unstable over $U_{\text {cit }}$


