??????????????????
????????
??????
??
???????*global*
????
$xA|x||A|\lambda[A]A\lambda_m[A] = -\max_i\{Re\{\lambda[A]\}\}$
$\mathcal{L}_{\infty e}x(t)\in I\!R^n \|x_t\| := \sup_{0\leq\tau\leq t}|x(\tau)|$
$\mathcal{K},\mathcal{K}_\infty$??
$\alpha\mathcal{K}\beta\mathcal{K}_\infty\pi\mathcal{K}\mathcal{L}\Psi$ *known* $\mathcal{K}\varphi,\bar{\varphi}$ *known*

$u\in I\!R y\in I\!R x f(\cdot,\cdot), g(\cdot,\cdot) h(\cdot,\cdot)(x_0,t_0)$??$[0,t_M)t_M$ *a priori*?[1]??$u(t)$
x??$uy\gamma_o\varphi_o(\cdot,\cdot,t)\bar{\varphi}_o(\cdot,t)t$
Definition 1 *A norm observer for system (??)–(??) is a m-order dynamic system of the form:*

with states $\omega_1\in I\!R$, $\omega_2\in I\!R^{m-1}$ and positive constants τ_1,τ_2 such that for $t\in[0,t_M)$: (i) if $|\varphi_o|$ is uniformly bounded by

where $\pi_o := \beta_o(|\omega_1(0)|+|\omega_2(0)|+|x(0)|)e^{-\lambda_o t}$ with some $\beta_o\in\mathcal{K}_\infty$ and positive constant λ_o.
?????

$\eta\eta\in I\!R^{n-\rho}\xi$

$(A_\rho,B_\rho)d(x,t)k_p(x,t)\neq 0$????[2]$\rho$
Remark 1(Normal Form) *For time invariant plants, the uniform relative degree assumption [?, ?] is a necessary and*
$T(x,t)k_p(x,t)d(x,t)y = h(x,t)$
$i=1,2,3\varphi_i(|x|,y,t)|x|yt\bar{\varphi}_i(y,t)yt\alpha_i(|x|)\mathcal{K}$
Assumption 1 *There exist* known *functions $\varphi_i,\bar{\varphi}_i,\alpha_i$ and a* known *positive constant c_p such that the following inequaliti*

where φ_i satisfies $\varphi_i(|x|,y,t)\leq\alpha_i(|x|)+\bar{\varphi}_i(y,t)$, β_T is some class-$\mathcal{K}_\infty$ function and γ_T is some scalar non-negative fun
$|T|x\bar{x}k_pT,k_pd\xi,k_pd\omega$????
??$tf(x,t),g(x,t)h(x,t)T,k_pdx$
Assumption 2 (Minimum-Phase) *There exists a storage function $V(\eta)$ satisfying $\underline{\beta}(|\eta|)\leq V(\eta)\leq\bar{\beta}(|\eta|)$ with $\underline{\beta},\bar{\beta}\in\mathcal{K}$*

$\forall x,y,\forall t\in[0,t_M)$, for some non-negative scalar function $\varphi_0(|\xi|,t)$, continuous in $|\xi|$ and piecewise continuous and uppe
????$\xi t\eta\xi$
Assumption 3 (Norm Observability) *The plant (??)–(??) admits a norm observer (Definition ??) for some* known
?????????????$\eta,yt\eta y$
u output tracking error

desired trajectory $y_m(t)$ reference model

$\xi_m := [y_m\dot{y}_m\ldots y_m^{(\rho-1)}]^T k_m>0 K_m\in I\!R^{1\times\rho}A_m r(t)$
Reducing Tracking to Regulation
????

$\xi_e := \xi-\xi_m$ *error input disturbance* d_e

$ux(0),\omega_1(0),\omega_2(0)$????????$e=\xi_1-\xi_{m1}$????$t\to\infty$
$\xi k_p d$ *modulo*??????