$\dot{x}=f(t,x)$ (1)

$f:[t_0,\infty)\times D\to R^n$

$t\in[t_0,\infty)$

$x\in D$

$x:[t_0,\infty)\to R^n$

$_nl_zeitvarwithinitialcondition_0)=x_0\in D\subset R^n$

$x_{\rm eq}\in D$

$_nl_zeitvarif:\forall t\in[t_0,\infty):f(t,x_{\rm eq})\equiv 0.$

$x_{\rm eq}\in D$

$_nl_zeitvariscalled\textbf{stable},iffforevery\varepsilon>0$

$t_0\geq 0$

$\delta(\varepsilon,t_0)>0$

$x_0\in D$

$x_0-x_{\rm eq}<\delta(\varepsilon,t_0)\Rightarrow x(t)-x_{\rm eq}<\varepsilon,forallt\geq t_0.$

$x_{\rm eq}$ $D=R^n$ $x_{\rm eq}$ **globally uniformly stable** $x_{\rm eq}$ δ t_0 **unstable**

$x_{\rm eq}\in D$

$_nl_zeitvariscalled\textbf{asymptotically stable},ifitisstableand\gamma(\varepsilon,t_0)>0$

$x_0\in D$

$_{0^-}x_{\rm eq}<\gamma(\varepsilon,t_0)\Rightarrow\lim_{t\to\infty}x(t)-x_{\rm eq}=0.$

$x_{\rm eq}$ $D=R^n$ $x_{\rm eq}$ **globally uniformly asymptotically stable** $x_{\rm eq}$ γ t_0

$_psfragIllustrationof(asymptotic)stabilityoftheequilibrium$

$x_{\rm eq}\in D$

$\gamma(t_0)>0$

$\lambda<0$

$x(t)-x_{\rm eq}\leq\gamma(t_0)e^{\lambda t}x_0-x_{\rm eq}forallt\geq t_0.$

$x_{\rm eq}$ $D=R^n$ $x_{\rm eq}$ **globally uniformly exponen-**