Park, Ju H.; **Jung, Ho Y.**

On the exponential stability of a class of nonlinear systems including delayed perturbations. (English) Zbl 1033.93055

J. Comput. Appl. Math. 159, No. 2, 467-471 (2003).

The authors consider the system

$$\dot{x} = F(x,t) + G(x,t)u(t),$$

whose equilibrium at the origin for $u(t) \equiv 0$ is exponentially stable, this property being ensured by a $\mathcal{C}^1$ Lyapunov function satisfying

$$\lambda_1^2|x|^2 \leq V(x,t) \leq \lambda_2^2|x|^2, \quad \frac{\partial V}{\partial t} + (\mathrm{grad}_x V)F(x,t) \leq -\lambda_3 V(x,t).$$

This system is perturbed by a delayed state dependent disturbance satisfying $|H(x,t)| \leq \beta|x|$. It is shown that the control law

$$u(t) = -\frac{G^T(x,t)(\mathrm{grad}_x V(x,t))^T \beta^2 \chi^2(t)}{|\mathrm{grad}_x V(x,t) G(x,t)|_\beta \chi(t) + \varepsilon e^{-\alpha t}}$$

exponentially stabilizes the system

$$\dot{x} = F(x(t),t) + G(x(t),t)[H(x(t-h(t),t) + u(t)], \quad 0 \leq h(t) \leq \overline{h}.$$

Here $\alpha > 0$, $\varepsilon > 0$ and $\chi(t) = \sup_{t-\overline{h} \leq \theta \leq \overline{h}} |x(\theta)|$.

Reviewer: Vladimir Răsvan (Craiova)

MSC:

93D15 Stabilization of systems by feedback
93C10 Nonlinear systems in control theory
93D09 Robust stability
93D21 Adaptive or robust stabilization

Keywords:

nonlinear system; exponential stabilization; time delay; Lyapunov function

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