NEW METHOD OF STUDYING STABILITY OF LURE' SYSTEM UNDER PARABOLIC REGULARITY

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ABSTRACT. A plant described by the abstract model in factor form

$$\left\{ \begin{array}{rcl} \dot{x}(t) & = & \mathcal{A}[x(t) + du(t)] \\ x(0) & = & x_0 \ , \end{array} \right\} \tag{0.1}$$

where $\mathcal{A} : (D(\mathcal{A}) \subset \mathrm{H}) \to \mathrm{H}$ is the infinitesimal generator of an *exponentially stable analytic* semigroup on a Hilbert space H with scalar product $\langle \cdot, \cdot \rangle_{\mathrm{H}}$ and with a linear $\mathcal{A}$–bounded *admissible* observation (output) functional

$$y = c^{\#} x \tag{0.2}$$

such that $d \in D(c^{\#}) \setminus D(\mathcal{A})$ is controlled by a *nonlinear feedback*

$$u(t) = -f[y(t)], \qquad f(0) = 0, \quad f \in \mathrm{W}^{1,\infty}(\mathbb{R}) \tag{0.3}$$

with Lipschitz constant m.

Here, the *admissibility* of $c^{\#}$ means that $s \longmapsto c^{\#}(sI - \mathcal{A})^{-1}x_0$ is in $\mathrm{H}^2(\mathbb{C}^+)$ for every $x_0 \in \mathrm{H}$.

We also assume that $\hat{g} \in \mathrm{H}^{\infty}(\mathbb{C}^+)$, where $\hat{g}$ denotes the *transfer function* of a linear part (0.1), (0.2) given by

$$\hat{g}(s) := sc^{\#}(sI - \mathcal{A})^{-1}d = c^{\#}d \ .$$

Motivated by the example of an electric $\mathfrak{RC}$–transmission line *we do not assume* that d is an *admissible factor control vector* which is a standard assumption in the existing stability theory of Lur'e system

$$\dot{x}(t) = \Big\{ \mathcal{A}[x(t) - df[c^{\#}x(t)]] \Big\} \ , \tag{0.4}$$

describing the closed–loop system dynamics.

Our aim in this presentation is to show that, making use of the *parabolic regularity* and replacing the admissibility of d by another verifiable assumptions, one can get the *global strong asymptotic stability* of the null equilibrium of (0.4) .

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