Comments and Corrections

Correction to "Global Asymptotic Saturated PID Control for Robot Manipulators"

Yuxin Su, Peter C. Müller, and Chunhong Zheng

In the above paper [1], the last term of (30) given by (31) is not well defined. The corrected definition of (31) should read as follows:

$$\int_0^{\phi} \sigma^T K_i \mathrm{Cosh}^2(\mathrm{Atanh}(\sigma - K_i^{-1} G(q_d)) d\sigma = \sum_{i=1}^{n} \int_0^{\phi_i} k_{ii} \cosh^2(\mathrm{atanh}(\sigma_i - k_{ii}^{-1} G_i(q_d)) \sigma_i d\sigma_i \quad (1)$$

where $G_i(q_d)$ denotes the ith component of the vector $G(q_d)$, and $\mathrm{Atanh}(\cdot) \in \Re^n$ is defined as follows:

$$\mathrm{Atanh}(\xi) = [\mathrm{atanh}(\xi_1), \ \ldots, \ \mathrm{atanh}(\xi_n)]^T \quad (2)$$

with $\xi = [\xi_1, \ldots, \xi_n]^T \in \Re^n$, and atanh$(\cdot)$ being the standard inverse hyperbolic tangent function.

It can be shown that (1) is positive definite with respect to ϕ because K_i and $\mathrm{Cosh}^2(\cdot)$ are diagonal positive-definite matrices, $\sigma_i|_{\sigma_i=0} = 0$, and σ_i is an increasing function with respect to σ_i. In addition, the time derivative of (1) is given by

$$\phi^T K_i \mathrm{Cosh}^2(\mathrm{Atanh}(\phi - K_i^{-1} G(q_d)) \dot{\phi}. \quad (3)$$

In light of (20) and (21) in [1], it follows that:

$$\begin{aligned} \phi^T K_i \mathrm{Cosh}^2(\mathrm{Atanh}(\phi - K_i^{-1} G(q_d)) \dot{\phi} &= \phi^T K_i \mathrm{Cosh}^2(\mathrm{Atanh}(\mathrm{Tanh}(\mathrm{z})) \dot{\phi} \\ &= \phi^T K_i \mathrm{Cosh}^2(\mathrm{z}) \dot{\phi}. \end{aligned} \quad (4)$$

After substituting [1, eq. (23)] into (4), we obtain the exact wanted term for its intended use.

Reference

[1] Y. Su, P. C. Muller, and C. Zheng, "Global asymptotic saturated PID control for robot manipulators," *IEEE Trans. Control Syst. Technol.*, vol. 18, no. 6, pp. 1280–1288, Nov. 2010.

Manuscript received March 25, 2014; accepted April 13, 2014. Date of publication May 8, 2014; date of current version December 15, 2014. Manuscript received in final form April 14, 2014. Recommended by Associate Editor T. Parisini.

Y. Su is with the School of Electro-Mechanical Engineering, Xidian University, Xi'an 710071, China (e-mail: yxsu@mail.xidian.edu.cn).

P. C. Müller is with the School of Safety Control Engineering, University of Wuppertal, Wuppertal D-42097, Germany (e-mail: mueller@srm.uni-wuppertal.de).

C. Zheng is with the School of Electronic Engineering, Xidian University, Xi'an 710071, China (e-mail: chzheng@xidian.edu.cn).

Digital Object Identifier 10.1109/TCST.2014.2320698