

Correction to "Absolute Stability Criteria for Multiple Slope-Restricted Monotonic Nonlinearities"

Wassim M. Haddad

In the above-mentioned paper,¹ absolute stability criteria for multiple slope restricted monotonic nonlinearities were given in terms of a *strict* positive real condition on $\mathcal{G}(s)$ defined by

$$\mathcal{G}(s) \triangleq \mu^{-1} + (I + Ns^{-1})G(s) \quad (1)$$

where $G(s)$ represents the transfer function of a linear dynamic system, μ is a positive-definite diagonal matrix, and N is a nonnegative-definite diagonal matrix. Upon closer inspection of the *strict* positive

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The author is with the School of Aerospace Engineering, Georgia Institute of Technology, Atlanta, GA 30332-0150 USA.

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¹W. M. Haddad and V. Kapila, *IEEE Trans. Automat. Contr.*, vol. 40, pp. 361–365, Feb. 1995.

real condition on $\mathcal{G}(s)$, it can be shown using the residue matrix $\lim_{s \rightarrow 0} s\mathcal{G}(s)$ that $\mathcal{G}(s)$ does not have a pole at the origin if $NG(0) = 0$. However, since it was assumed in [1] that $\det G(0) \neq 0$, it follows that we require $N = 0$ in order to ensure *strict* positive realness of (1). In this case (1) collapses to a standard positivity test, and the resulting Yakubovich–Kalman–Popov (YKP) conditions in [1] specialize to the YKP conditions for ensuring strict positivity of $\mu^{-1} + G(s)$, which guarantees absolute stability for arbitrarily time-varying nonlinearities without any slope restrictions. In order to correct this oversight the following corrections need to be made to Theorem 3.1.¹

- 1) Theorem 3.1 should include the assumptions that $(A, C + NC'A^{-1})$ is observable and $NG(0) = G^*(0)N$ is positive definite.
- 2) In Theorem 3.1, "let N be nonnegative definite" should be replaced by "let N be positive definite."
- 3) In Theorem 3.1, "strictly positive real" should be replaced by "positive real."

Note that with the first assumption given in 1), (A_a, L) is observable.