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Letter to the Editor

Remarks on “Delay-independent stability of retarded dynamic systems of multiple degrees of freedom”

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The paper [1] has developed a systematic approach to the delay-independent stability analysis for a class of linear retarded dynamic systems of multiple degrees of freedom, possibly with two time delays.

However, there is an incompleteness in Ref. [1] that a possible root $\omega = 0$ of the derived function $F(\omega)$ (or $G(\omega^2)$) was not taken into consideration in the delay-independent stability analysis. This incompleteness makes it possible that some special points are not included in the delay-independent stable region. For example, for system (14) in this paper, the authors obtained that the system is delay-independently stable if and only if $a + b < 0$ and $b^2 - a^2 < 0$. But the right conditions should be $a + b < 0$ and $b^2 - a^2 \leq 0$ (This result can also be found in Ref. [2] (named R2) in this paper). Another example is, for system (21) and $\tau_1 = \tau_2$, the authors obtained condition (23) which corresponds to condition (ii) in Theorem 2. But condition (23) is not identical to that in R2 because the latter is either $A \geq 0$, $B \geq 0$, or $A < 0$, $A^2 - 4B < 0$.

To make up this incompleteness, there are two main revisions:

1. Revise the stability condition concerning ‘ $F(\omega)$ has no real roots’ to that ‘ $F(\omega)$ has no nonzero real roots’.
2. Revise the stability condition concerning ‘ $G(\omega^2)$ has no real roots’ to that ‘ $G(\omega^2)$ has no nonzero real roots’.

Due to Revisions 1 and 2, the stability region should be obtained according to the new stability conditions in Section 4, but the main results are kept unchanged because there is no difference between the statement ‘ $F(\omega)$ or $G(\omega^2)$ has no nonzero real roots’ and ‘ $F(\omega)$ or $G(\omega^2)$ has no real roots’ in the examples of Section 4.

In addition, the delay-independent conditions for system (14) should be $a + b < 0$ and $b^2 - a^2 \leq 0$; formula (23) in Ref. [1] should be replaced by

$$A \geq 0, B \geq 0, \text{ or } A < 0, A^2 - 4B < 0. \quad (1)$$

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References

- [1] Z. Wang, H. Hu, Delay-independent stability of retarded dynamic systems of multiple degrees of freedom, *Journal of Sound and Vibration* 226 (1999) 57–81.