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Relations between novel types of D-stability with applications to ODE dynamics

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Abstract

Novel types of D-stability (namely, relative D-stability with respect to a shifted half-plane $\mathbb{C}_{\alpha}^{-}$, a conic sector $\mathbb{C}_{\theta}^{0}$ and a stability parabola $P(\epsilon)$), were studied in [1]. Their different applications led to a deep study of relations between the classical concept of D-stability and these new concepts.

It is well-known that a second-order ODE system admits a general matrix form of notation. Basing on the novel types of matrix D-stability, we provide new stability conditions for second-order dynamical systems and analyze the stability of a parameter-dependent second-order model. Next, we discuss the relations between transient response properties of a second-order ODE system and novel types of matrix D-stability. We provide the conditions when the system has a given minimal decay rate α and the minimal damping ratio $\zeta = \cos(\theta)$ and when these characteristics are preserved for some variations of positive parameters.

References

[1] O. Kushel, *Unifying matrix stabiity concepts with a view to applications*, SIAM Rev., **61(4)** (2019), 643-729.

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