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Delay Differential Systems with Time-Varying Delay: New Directions for Stability Theory.

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Abstract: In this paper we give an example of Markus–Yamabe instability in a constant coefficient delay differential equation with time-varying delay. For all values of the range of the delay function, the characteristic function of the associated autonomous delay equation is exponentially stable. Still, the fundamental solution of the time-varying system is unbounded. We also present a modified example having absolutely continuous delay function, easily calculating the average variation of the delay function, and then relating this average to earlier work of the author on preservation of the stability exponent in delay differential equations with time-varying delay. In this way we suggest one possible viewpoint on the conditions for Markus–Yamabe instability. Finally, we give a very brief sketch of an example of quenching of instability. To suggest a view on conditions for quenching phenomena, we relate this to earlier work of Cooke on preservation of spectral dynamics in delay systems having time-varying delay.

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