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NONOSCILLATION, ASYMPTOTIC PROPERTIES AND STABILITY OF SECOND ORDER DELAY DIFFERENTIAL EQUATIONS

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Delays, arising in nonoscillatory and stable ordinary differential equations, can induce oscillation and instability of their solutions. That is why the traditional direction in the study of nonoscillation and stability of delay equations is to establish a smallness of delay, allowing delay differential equations to preserve these convenient properties of ordinary differential equations with the same coefficients.

In this paper, we find cases in which delays, arising in oscillatory and asymptotically unstable ordinary differential equations, induce nonoscillation and stability of delay equations. We demonstrate that, although the ordinary differential equation

$$x''(t) + c(t)x(t) = 0$$

can be oscillating and asymptoticaly unstable, the delay equation

$$x''(t) + a(t)x(t - h(t)) - b(t)x(t - g(t)) = 0,$$

where $c(t) = a(t) - b(t)$, can be nonoscillating and exponentially stable. Results on nonoscillation and exponential stability of delay differential equations are obtained. On the basis of these results on nonoscillation and stability, the new

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possibilities of non-invasive (non-evasive) control, which allow us to stabilize a motion of single mass point, are proposed.

Stabilization of this sort, according to common belief requires damping term in the second order differential equation. Results obtained in this talk refute this delusion.

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