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Dedicated to Professor Ioan A. RUS on the occasion of his 70^{th} anniversary

The study of some nonlinear dynamical systems modelled by a more general Rayleigh-Van Der Pol equation

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ABSTRACT. In this paper, we study the mathematical model for nonlinear dynamical systems with distributed parameters given by a generalized Rayleigh-Van der Pol equation. In the autonomous case and in the non-autonomous case, conditions of stability, bifurcations, self-oscillations are studied using criteria of Liapunov, Bendixon, Hopf [11], [12]. Asymptotic and numerical methods are often used [5]. The equation has the form

$$\ddot{x} + \omega^2 x = \left(\alpha - \beta x^2 - \gamma \dot{x}^2\right) \dot{x} + f(t),$$

where resonance and limit cycles can be remarked [1]. Note that for $\beta = 0$, $\alpha \neq 0$, $\gamma \neq 0$ we have the Rayleigh equation [1], while for $\gamma = 0$, $\alpha \neq 0$, $\beta \neq 0$ we have the Van der Pol equation [2],[3]. Besides the theoretical study, the applications to techniques are very important: dynamical systems in the mechanics of vibrations, oscillations in electromagnetism and transistorized circuits [6], the aerodynamics of the flutter with two degrees of freedom [8], are modelled by this hybrid equation proposed by authors.

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