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Instability for Nonlinear Differential Equations of Fifth Order Subject to Delay

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Abstract: This paper studies the instability of zero solution of a certain fifth order nonlinear delay differential equation. Sufficient conditions for the instability of zero solution of the equation considered are obtained by the Lyapunov-Krasovskii functional approach.

Keywords: *instability; Lyapunov–Krasovskii functional; delay differential equation; fifth order.*

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1 Introduction

It is well known that in applied sciences some practical problems concerning physics, mechanics and the engineering technique fields associate with differential equations of higher order (Chlouverakis and Sprott [1] and Linz [9]) . Therefore, the investigation of qualitative behaviors of solutions of nonlinear differential equations of higher order has a great importance in theory and applications of differential equations. In particular, by now, several authors have contributed to the theoretical study of instability of solutions of some fifth order nonlinear differential equations without delay (Ezeilo [3–5], Li and Duan [7], Li and Yu [8], Sadek [11], Sun and Hou [12], Tiryaki [13], Tunç [14–16], Tunç and Erdoğan [21], Tunç and Karta [22], Tunç and Şevli [23]). Throughout all of the mentioned papers, based on Krasovskii's properties (Krasovskii [6]), the Lyapunov's second (or direct) method has been used as a basic tool to prove the results established on the instability of solutions, since differential equations studied cannot be solved explicitly. This method, invented by the Russian mathematician Lyapunov in 1892, proves to be

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