

## Practical exponential stability for time-varying systems with nonlinear delayed perturbations

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**Abstract.** In this paper, we derive some sufficient conditions for practical uniform exponential stability of time-varying perturbed systems with nonlinear delayed perturbations is derived by using an improved Lyapunov-Krasovskii functional, whose dynamics are in general unbounded in time, in the sense that the solutions are uniform stable and converge to a small neighborhood of the origin. Furthermore, some illustrative example is presented.

**Keywords.** Practical exponential stability, Linear time-varying system, nonlinear perturbation, time delay, Lyapunov equation.

**AMS (MOS) subject classification:** 34D20, 93C05, 93C73, 37B25.

### 1 Introduction

The delay systems are mathematical models that are the basis of real-world phenomena such as nuclear reactors, biological systems, and the dynamics people....The question addressed in this paper is related to the study of the stability when considering a system with a delay perturbation term([4],[5]). In all previously mentioned works, one of the main hypothesis is that the dynamic of the system are bounded in time([1],[9],[10],[2]). From an engineering point of view, this assumption is strict, since in many design problems like tracking control and feedback stabilization, the stability analysis concerns systems whose dynamics are in general unbounded with respect to time. The analysis of the stability of dynamic systems with a delay has been more considerable research efforts. Recently, performance improvements were reported summers using Lyapunov-Krasovskii methods and techniques of linear matrix inequalities. The majority of existing work concerning particular classes of dynamical systems with delay ([5]), but in the general case, an equation differential functional nonlinear multiple delays is little studied in the literature. Thus, motivated by the problems of stability of nonlinear systems with multiple delays not autonomous, we study the practical stability already introduced and studied by several authors([2]). It is in this context is the objective of this paper. In addition, we discuss the problem of exponential stability overall uniform practice for a class of delay systems, whose