Stability in the Models of Real World Phenomena

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Abstract: In this paper we consider several examples of real world models to illustrate the general methods of stability analysis of nonlinear systems developed recently in the Department of Processes Stability of S.P. Timoshenko Institute of Mechanics of NAS of Ukraine.

Keywords: robot dynamics and control; neural networks on time scales; lasers; dynamic economic models; fuzzy control; scalar and vector Lyapunov functions.

Mathematics Subject Classification (2000): 70E60, 92B20, 78A60, 91B62, 93C42, 93D30.

1 Introduction

In this paper, we offer several examples of real world models to illustrate the general methods of stability analysis developed in the books [8, 16, 17].

Section 2 deals with the motion stability problem of robot motion whose mathematical model takes into account the dynamics of the environment interacting with the robot. We apply here some integral inequalities from Chapter 1 of the book [8].

In Section 3, we consider neural networks on time scales and introduce the study of the stability problem in this new direction.

In Section 4, we consider a problem of stability of regular synchronous generator of optical connected lasers.

Section 5 presents models from economics and using the method of vector Lyapunov functions proves that a market tends to some given evolution independent of initial conditions.

Finally in Section 6, we analyze a model of impulsive Takagi–Sugeno systems with application to the mathematical model in population growth under the impulsive control.

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