

NEW RESULTS ABOUT INSTABILITY OF NONLINEAR ORDINARY VECTOR DIFFERENTIAL EQUATIONS OF SIXTH AND SEVENTH ORDERS

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Abstract. This work presents new results about the instability of zero solution of some certain non-linear ordinary vector differential equations of sixth and seventh orders. Namely, we improve some well-known instability results into certain nonlinear ordinary vector differential equations of sixth and seventh orders [20].

Keywords. Nonlinear differential equations, sixth order, seventh order, instability, Lyapunov's second method.

AMS (MOS) subject classifications: 34D05, 34D20.

1 Introduction

The instability behaviors of solutions of higher order nonlinear ordinary differential equations, third-, fourth-, fifth-, sixth-, seventh and eighth order, were investigated by many authors, see for instance [1], [2], [3], [4], [5], [6], [7], [8], [9], [10], [11], [12], [15], [16], [17], [18], [19], [20], [21], [22], [23], [24], [25], [26], [27], [28], [29], [30], [31], [32], [33] and the references cited therein. In all of the studies mentioned above, the Lyapunov's second method [13] (or direct method) has been employed as a basic tool to investigate the problem concerning to the equation under consideration. This case, perhaps, is due to the effectiveness of the Lyapunov's second method. That is to say, the major advantage of this method is that instability of solutions can be obtained without any prior knowledge of solutions. Its chief characteristic is based on the construction of an appropriate scalar function, the Lyapunov function, for the equation under investigation. But, finding an appropriate Lyapunov function for higher order nonlinear differential equations is in general a difficult task. To the best of our knowledge, perhaps due to this fact, the instability of solutions of nonlinear scalar differential equations of sixth and seventh order has been rarely considered in the literature. In fact, the related works existing in the literature can be summarized as follows: Namely, for the scalar case, that is for $n = 1$, in 1982, Ezeilo [6], in 1990, Tiryaki [22] and, in 2000, Tejumola [20] discussed the instability of the trivial solution $x = 0$ of the following nonlinear differential equations: