



On the Existence of a Common Lyapunov Function for a Family of Nonlinear Mechanical Systems with One Degree of Freedom

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Abstract: Certain classes of essentially nonlinear switched mechanical systems with one degree of freedom are investigated. The conditions are obtained under which, for the families of subsystems corresponding to switched systems, there exist common Lyapunov functions of the prescribed form. The fulfilment of these conditions provides the asymptotic stability of equilibrium positions of switched systems for any switching law.

Keywords: *switched mechanical systems; nonlinear forces; asymptotic stability; common Lyapunov function.*

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1 Introduction

Stability analysis and synthesis of switched systems are fundamental and challenging research problems, see, for example, [4, 7, 11]. In some cases it is required to design a control system in such a way that it remains stable for any admissible switching law [7, 11]. These cases are natural, when switching signal is either unknown, or too complicated to be explicitly taken into account.

A general approach to the above problem is based on the computation of a common Lyapunov function (CLF) for a family of subsystems corresponding to the switched system. This approach has been effectively used in many papers, see [4, 7–9, 11]. However, the conditions of the existence of a CLF are not completely investigated even for the case of families of linear time-invariant systems [7–9].

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