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ON STABILITY OF DIFFERENTIAL EQUATIONS WITH PIECEWISE CONSTANT ARGUMENT USING DICHOTOMIC MAPS

S. A. S. Marconato[1], M. A. Bená[2] and A. Spezamiglio[3]

[1]Department of Mathematics
UNESP, CP 178, 13506-900 - Rio Claro, SP, Brasil

[2]Department of Physics and Mathematics
USP, 14040-901 - Ribeirão Preto, SP, Brasil

[3]Department of Mathematics
Unesp, 15054-000 - São José do Rio Preto, SP, Brasil
Corresponding author email:sasmarc@rc.unesp.br

Abstract. This paper deals with the study of the basic theory of existence, uniqueness and continuation of solutions of differential equations with piecewise constant argument. Results about asymptotic stability of the equation $\dot{x}(t) = -bx(t) + f(x([t]))$ with argument $[t]$, where $[t]$ designates the greatest integer function, are established by means of dichotomic maps. Other example is given to illustrate the application of the method.

Keywords. Piecewise constant argument; Liapunov stability; Dichotomic maps.

AMS (MOS) subject classification: 34K20.

1 Introduction

The study of differential equations with piecewise continuous argument has been subject of many recent investigations [3] and in the stability study of this type of equation using dichotomic maps, some literature can be cited [1,2,4,5,6,7]. A potential application of this equation is in the stabilization of hybrid control system, by which we mean one with a continuous plant and with a discrete controller.
But, we observe that the existence and uniqueness theorems, as well as, results about continuation of solutions to this specific differential equation, can not be found in the specialized bibliography.

In this way, we present in this paper the basic theory for that equation and apply the theory of dichotomic maps to prove that the null solution of the equation

$$\dot{x}(t) = -bx(t) + f(x([t]))$$

is asymptotically stable, with some imposed conditions on the function f and the parameter b.
This result is an extension of the study of the equation

$$\dot{x}(t) = -bx(t) + cx([t])$$