

## MODELLING AND CONTROL OF FOUR TANKS MIXED LOGIC DYNAMICAL (MLD) SYSTEM

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**Abstract.** In this paper we present the modeling and control of a hydraulic process in the framework of Mixed Logic Dynamical (MLD) systems. In general these systems are described by linear dynamic equations subject to linear inequalities involving real and integer variables, but several alternatives can be chosen that lead to different formulations of the control problem. These alternatives are discussed in relation to the target process as well as the formulation of the (predictive) controller which can be formulated as an Mixed Integer Quadratic Programming (MIQP) optimization problem. The paper shows also several tests of the behavior of the MPC controller against strong disturbances.

**Keywords.** Hybrid systems; Mixed Logic Dynamical (MLD) systems; Model Predictive Control (MPC); Mixed Integer Quadratic Programming (MIQP); Hybrid Model Based Predictive Control(HMBPC).

### 1 Introduction

The topic of hybrid systems and hybrid control has received a lot of attention in the latest years, mainly in relation with complex distributed systems that combine interconnected continuous semiautonomous units with global operating rules of discrete or logical nature. In this paper, the topic of hybrid control is considered from a process control perspective. In this field, the core of the process is continuous and the main variables are represented by real numbers, but there are also very often other elements that do not fit in this framework and, nevertheless, are essential in its functioning. Examples of them are:

- Devices or elements that operates in an on/off way and that can be represented by binary variables instead of usual real ones. As typical examples we can mention solenoid valves or motors.
- Variable structure systems with process units that operate only in certain situations and they are switched off according to the production needs or constraints satisfaction.