plan

September 8, 2016

1 Introduction

Objective: control of switched PDEs/ controlled PDEs, high dimensional switched systems (ODEs)

2 Control of switched systems represented by ODEs

2.1 Definition of a switched system

2.2 State-of-the-art methods for the control of switched systems

- Lyapunov approaches
- state space discretization (Antoine Girard)
- Optimal control (HJB, optimization)

2.3 MINIMATOR

2.3.1 Linear systems

Romain Soulat

2.3.2 Nonlinear systems

article avec Alexandre Chapoutot et Julien Alexandre

2.3.3 Distributed systems

article avec Nicolas Markey

2.3.4 Other systems

article sur les boolean systems

3 Application to the control of (discretized) PDEs

3.1 MOR methods, and why they are needed

Control algorithms are expensive, need of reducing the computational cost:

- MOR
- Distributed control

Issues with MOR:
Switched = need of several RO models ?
Problem of boundary conditions
MOR methods:

- Controller methods: Balanced truncation, moment matching method
- Computational mechanics methods: POD, PGD, spectral methods

3.2 Analysis

What is needed:

- representing the short time behavior precisely (with a switched system, one never reaches a stationary solution)
- one reduced state space (common for the possibly multiple RO models): interpolation?
- dimension < 10
- no dirichlet BC ? (Florian ?)
- an initial reduced state rectangle

3.3 Theoretical results

Theoretical results (cf. Florian)

3.4 Numerical approaches

3.4.1 Control of PDEs with balanced truncation

article SynCop + journal

3.4.2 Control of more complicated PDEs with PGD (WIP)

One ROM per zonotope, the ROMs are built during the decomposition
NB: need of an initial condition to build the PGD.
We want to control a zonotope Z centered in c.
Interpolated points given by matrix C (to begin: random interpolated points)
minimization of:

$$\min_{u_0} \beta \|Cu_0 - c\|^2 + \alpha_1 \|u_0 - sol_1(x, \tau)\|^2 + \alpha_2 \|u_0 - sol_2(x, \tau)\|^2 \tag{1}$$

where

$$sol_1(x, \tau) = u_1^{\infty}(x) + exp(-A\tau)(u_0(x) - u_1^{\infty}(x)) \tag{2}$$

NB: L-curve

4 Reconstruction/Observation ?

article avec Mario Sigalotti