

Computer tutorial on inverse problems and OED

Alen Alexanderian

Department of Mathematics
North Carolina State University

July 30, 2019

The model problem

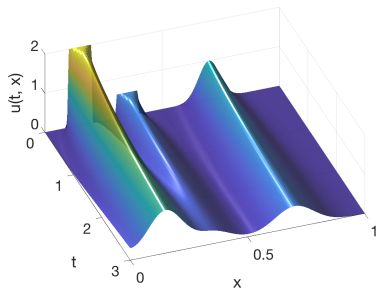
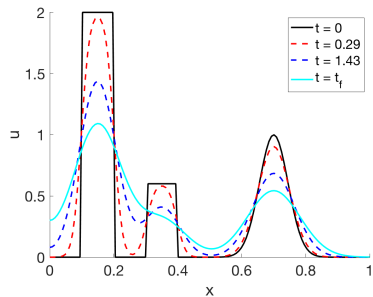
Goal: Explore impact of experimental design on inverse problem solution in a simple example

Model problem: 1D heat equation

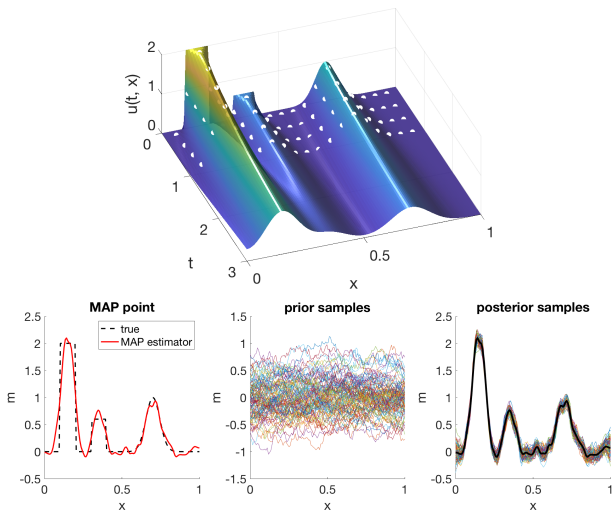
$$\begin{aligned}u_t &= \kappa u_{xx} & x \in (0, 1), t \in (0, T) \\u(0, x) &= m(x) & x \in [0, 1] \\u_x(0, t) &= u_x(1, t) = 0 & t \in [0, T]\end{aligned}$$

Inverse problem: use space/time measurements of temperature to reconstruct initial state; this is a linear inverse problem; inversion parameter is the function $m(x)$

Forward simulation



Bayesian inversion



Getting the codes

Download the codes from:

<https://aalexan3.math.ncsu.edu/rtg19/rtg.html>