Autumn School Lisbon - Data Driven Computations in Life Sciences - Fall 2015

Nov 13th 2015

Tutorial 2 - An Identification Problem

Exercise 1. Consider the following problem in the unit square Ω:

$$-\nu\Delta u+\beta\cdot\nabla u+u^3=\alpha_1\sin(x+y)+\alpha_2\cos(x+y)$$

with $u(\partial\Omega)=0$.

Given measures u_d in a region I of Ω, identify the coefficients α_1 and α_2 with a variational procedure.

Let us assume $\nu=0.1$, $\beta=[1,1]$. At the beginning, let us set $I\equiv\Omega$.

In particular we minimize the mismatch $\int_I (u-u_d)^2$ with a Tychonov regularization $\sigma(\alpha_1^2+\alpha_2^2)/2$.

Procedure specification:

1) Write the Lagrangian functional associated with the problem

2) Write the associated KKT system

3) Use a Netwon linearization

4) Solve the problem

5) Repeat the solution for different values of the regularization parameter

6) Analyze the quality of the solution when I is a circular subdomain (for different values of the position and the radius) in the square.

7) Pollute the data with a random noise

8) Try a δ^2 Aitken acceleration

9) Explore BFGS-based methods.