UNIVERSITÄT DES SAARLANDES
Fakultät 6.1 Mathematik
WS 08/09

Chair: Prof. Louis
Lecturer: Dr. A. Lakhal
Lecture: Wednesdays 10-12 A.M. in room (HS IV),
Starting: October the 22d

Lecture: "Stable methods for least-square problems"

A basic problem in many branches of sciences, engineering and economy is to fit a model to observations subject to errors. This is a typical *inverse problem,* where form a series of n system measurements $y_i = y_i(t_i)$, $i = 1 \dots n$, and using a conjuctured model φ containing unknown parameters x, we are concerned with determining these parameters in such a way that model and measurements *" match best possible".* This can be formulated as a least-square problem of type

$$\sum_{i=1}^{n} w_i (y_i - \varphi(t_i, x))^2 \quad \text{minimal},$$

where the weight-functions w_i are to be determined within the problem to permit a reasonable practical interpretation. It is clear that the *existence* and *uniqueness* of the solution to this problem depends on the "relevance" of the observations. Furthermore, it is of crucial importance to have a *stable* solution, where the accuracy of the sought-for parameters should be enhanced when the precision on the observations increases. Otherwise we have to deal with the instability of the solution using *regularization* techniques. This lecture aims to introduce stable methods for least-square and inverse problems, discuss them from theoretical and numerical point of view and illustrate them using practical examples. It is attended to advanced-bachelor and master students in mathematics, computer sciences or engineering.
This lecture will be given in english.

References:

1. Björck A: Numerical Methods for Least-Square Problems, SIAM 1996.
2. Louis A.: Inverse und schlecht gestellte Probleme, Teubner 1989.
3. Engel H. W., Hanke M. and Neubauer A.: Regularization of Inverse Problems, Kluwer 1996.