Identification of the diffusion coefficient in a one and two dimensional parabolic equation by regularization techniques using two parameters

Many inverse problems have their origin in the science, the medicine and the ingeneering. In mathematics applied the partial differential equations are used to study some physical problems. These problems are in general inverse problems whose nature is not lineal. To determine a mathematical model completely is required to know the coefficients or the terms source that determine the system and that are related to their joint physical properties with the initial and/or boundary conditions.

Hadamard introduced the concept of problem well - possed in the sense that the mathematical model of a physical problem has the properties of uniqueness, existence and stability of the solution. If one of these properties fails we will call him problem ill-possed.

Identification of parameters of a physical system is one of the branch of the theory of inverse problems. When one or several coefficients or the term source of the system are unknown, we have in this case an inverse ill posed problem. These problems are related to the decision of physical properties by means of observations made on the boundary of a determined region, as occurs in medicine, in the case of the study of internal organs (tomography), in reconstruction of images, in exploration and exploitation of petroleum, in ecological problems and in geology (study of materials that are found lunder land). These inverse problems are characterized because they do not have solution, or there is not uniqueness or there is not continuity in the data. In these cases, these problems are ill-posed and a way to treat these problems is regularization techniques.

In this talk, we will consider the inverse problem to identify a coefficient of diffusion in the one and two dimensional parabolic equation. To resolve this inverse problem is needed an additional information that comes from measures in the interior of the control. The approximations in the identification of the coefficient are based on the application of a new method of regularization, call generalization of Tikhonov, for not lineal problems, that depends on two parameters and we will find the numerical formulas of this method, for the implementation in the computer. Finally we will show some numerical examples of interest for the one dimensional case.