Abstract

After the Introduction, in which we recall some preliminary results and summarize the main contributions of this work, the thesis is divided in two main parts:

In the first one (Chapters 2, 3 and 4), we deal with iterative algorithms for the numerical resolution of convex optimization problems and maximal monotone variational inequalities in Hilbert spaces. In particular, in Chapters 2 and 3 we design two new splitting methods for problems with smooth + non-smooth structure. Moreover, we analyse the main properties of the algorithms, we prove the convergence of the sequence, we give examples of applications and numerical illustrations. In Chapter 4, we study the convergence rate of a pre-existing algorithm named FDR (Forward-Douglas-Rachford splitting method). We analyse both the global behaviour and the local one (the latter, under the assumption of partial smoothness).

In the second part of the thesis we dedicate to the study of optimal control of evolutionary PDEs, focusing on parabolic equations. We study the minimization of a functional involving the cost of the control and a trajectory regulation, plus an approximate-controllability constraint on the final state. Using the spectral decomposition of the operator, we obtain one-shot (i.e. non-iterative) algorithms for the numerical resolution of the problem. We consider two cases: when the control is the initial datum (Chapter 5) and the case of distributed control (Chapter 6).

We conclude with a chapter about the current work and future perspectives.