Abstract

In this dissertation we present a priori and a posteriori error analyses for PDE–constrained optimization problems. After a brief introduction and some preliminary results (Chapters 1 and 2), we divide this thesis into two main parts, namely, Chapters 3–5 and Chapters 6–8, respectively.

In the first part of this manuscript we propose and analyze a posteriori error estimators for optimal control problems involving nonlinear state equations: a semilinear elliptic PDE (Chapter 3), the Navier–Stokes equations (Chapter 4), and a bilinear elliptic PDE (Chapter 5). For each one of these problems we devise a posteriori error estimators and prove, on the basis of second order sufficient optimality conditions, their reliability; efficiency properties of the aforementioned a posteriori error estimators are also studied.

The second part of this dissertation is devoted to the analysis of optimal control problems that involve point evaluations of the state variable in the cost functional. More precisely, in Chapters 6 and 7 we develop a priori error analyses for pointwise tracking optimal control problems involving, respectively, a semilinear elliptic PDE and the Stokes equations. Additionally, in Chapter 7, we study a particular optimal control problem in which the control variable corresponds to the amplitude of forces modeled as point sources. Finally, Chapter 8 is devoted to the development of a reliable and efficient a posteriori error estimator for the pointwise tracking optimal control problem of the Stokes equations analyzed in Chapter 7.