The aim of this thesis is to develop topology optimization methodologies for two different multiphysical problems: Thermoelectric energy conversion and fluid-structure-interaction. The thesis is divided into four chapters: The motivation of the study, the relevant literature and a general introduction to the concept of topology optimization are laid out in Chapter 1. To develop a topology optimization framework is an iterative process where a considerable amount of challenges are faced. With a point of departure in my own PhD project, recommendations to overcome these challenges are discussed in Chapter 2. The chapter can be skipped without losing the meaning of the remaining part of the thesis. Chapter 3 and 4 are build up equivalently, can be read independently and are concerned with topology optimization for thermoelectric energy conversion and fluid-structure-interaction problems, respectively. The chapters begin with an introduction to the multiphysics concepts where important model parameters are identified, relevant literature is reviewed and the governing partial differential equations are stated. The chapters are concluded with suggestions to future research and a bread overview of the most important findings of the journal papers which have been submitted as part of the thesis.