MASTER'S THESIS

Preconditioners for linear parabolic optimal control problems

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ABSTRACT

In this thesis, we consider the computational methods for linear parabolic optimal control problems. We wish to minimize the cost functional while fulfilling the parabolic partial differential equations (PDE) constraint. This type of problems arises in many fields of science and engineering. Since solving such parabolic PDE optimal control problems often lead to a demanding computational cost and time, an effective algorithm is desired. In this research, we focus on the distributed control problems. Three types of cost functional are considered: Target States problems, Tracking problems, and All-time problems. Our major contribution in this research is that we developed a preconditioner for each kind of problems, so our iterative method is accelerated.

In chapter 1, we gave a brief introduction to our problems with a literature review. In chapter 2, we demonstrated how to derive the first-order optimality conditions from the parabolic optimal control problems. Afterwards, we showed how to use the shooting method along with the *flexible generalized minimal residual* to find the solution. In chapter 3, we offered three preconditioners to enhance our shooting method for the problems with symmetric differential operator. Next, in chapter 4, we proposed another three preconditioners to speed up our scheme for the problems with non-symmetric differential operator. Lastly, we have the conclusion and the future development in chapter 5.

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