SOLVING OPTIMAL CONTROL PROBLEMS CONTAINING UNCERTAINTY

PELIN ÇILOĞLU, HAMDULLAH YÜCEL*

ABSTRACT

PDE–constrained optimization problems arise in a wide variety of traditional applications in, e.g., automotive and aerospace industries and chemical processing, as well as applications in recently emerging technologies in neural networks. However, due to the lack of knowledge or inherent variability in the model parameters, such real-problems formulated by mathematical models generally come with uncertainty concerning computed quantities.

In this talk, we investigate a numerical analysis of a robust deterministic optimal control problem subject to a convection diffusion equation containing uncertain inputs. Stochastic discontinuous Galerkin method provides an efficient alternative to sampling methods for the numerical solution of the underlying optimization problems. In order to compute the stochastic discontinuous Galerkin solution for a given problem, one needs to solve a large coupled system of linear equations in the form of a sum of tensor product matrices. We address this issue by using the low-rank variant of GMRES method, which reduces both the computational complexity and the memory requirements by exploiting a Kronecker–product structure of system matrices. The efficiency of the proposed methodology is illustrated by the benchmark problems with and without control constraints.

* Institute of Applied Mathematics, METU, 06800, Ankara, Turkey, yucelh@metu.edu.tr