Internal Numerical Differentiation for Optimum Experimental Design for Parameter Estimation of 2D PDE Problems

The numerical solution of the optimum experimental design problem for parameter estimation with Partial Differential Equations (PDEs) of advection diffusion type is considered. To solve such problems in particular derivatives of the underlying PDE solution are required. For the computation of these derivatives we present special tailored methods of Internal Numerical Differentiation applied to the PDE discretized by the discountinuous Galerkin method. Structure exploitation is obtained by applying Algorithmic Differentiation to particular parts of the discretized PDE. This reduces the computational cost. Moreover, mesh adaptivity is treated in a suitable way to obtain accurate discrete derivatives that approximate their continuous counterparts. As an example we will consider the problem of optimal sampling design, i.e. the optimization of sensor locations.

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