

**Master seminar, summer term 2021**  
“The Discontinuous Galerkin Method”

Many phenomena in our daily life can be described via partial differential equations. Amongst many others, this is the case for the heat distribution in a room or the oscillations of a violin string, as well as the sound waves emitted by such oscillations. However, a closed formula for the solution of such equations is seldom available, save for some very specific, unrealistic model problems. This raises the need for numerical methods to approximate the solution of such problems.

One particularly suited numerical method is the discontinuous Galerkin (dG) method, a variant of the well-known finite element method (FEM). In contrast to the more traditional, continuous FEM, dG allows for discontinuities across the edges of the underlying mesh. This approach turns out to be very flexible, as problem specific properties can be incorporated into the numerical fluxes that connect the otherwise uncoupled elements. It is particularly advantageous if the exact solution to a problem does not fulfill the strict continuity conditions of the continuous FEM, as it is often the case for hyperbolic or nonlinear problems.

This seminar is based upon the extensive textbook “Mathematical Aspects of Discontinuous Galerkin Methods” by Daniele Antonio DiPietro and Alexandre Ern. The seminar talks start by covering the mathematical basics needed to construct and analyze the dG method. Subsequently, the method will be applied to scalar linear model problems for which stability as well as error analysis will then be performed. If time permits, various extensions will be covered, like dG for nonlinear problems or more general, e.g., vector-valued linear problems.

**Prerequisites.** Numerical Analysis 1+2, Numerics of ordinary differential equations and Finite Elements.

**Date.** The seminar will take place online. The final date will be set in the preliminary meeting.

**Preliminary meeting.** Tuesday, February 9, 2021, 1:30 pm, in zoom.

Please subscribe to the corresponding ILIAS course if you are interested in taking part in the seminar. There, you will also find the link to the zoom room, in which the preliminary meeting takes place.

sgd, Prof. Dr. Marlis Hochbruck