

## Cell centered Galerkin methods for diffusive problems

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In this work we introduce a new class of lowest order methods for diffusive problems on general meshes with only one unknown per element. The underlying idea is to construct an incomplete piecewise affine polynomial space with sufficient approximation properties starting from values at cell centers. To do so we borrow ideas from multi-point finite volume methods, although we use them in a rather different context. The incomplete polynomial space replaces classical complete polynomial spaces in discrete formulations inspired by discontinuous Galerkin methods. Two problems are studied in this work: a heterogeneous anisotropic diffusion problem, which is used to lay the pillars of the method, and the incompressible Navier-Stokes equations, which provide a more realistic application. An exhaustive theoretical study as well as a set of numerical examples featuring different difficulties are provided.

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