## Higher regularity for elliptic systems with mixed boundary conditions

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In the situation of a smooth boundary with pure Neumann or Dirichlet boundary conditions, it is well known that the regularity of a weak solution  $u \in H^1(\Omega)$ to linear elliptic systems can be improved to  $u \in H^2(\Omega)$ . This changes completely when considering polyhedral domains (which contain edges and vertices) and when Neumann and Dirichlet conditions meet at the boundary.

In this talk, we consider polyhedral domains in two and three dimensions and classify boundary configurations that must be addressed to achieve higher regularity. A strategy is presented which is able to handle mixed boundary conditions in a two-dimensional angle (or a three-dimensional edge), reducing the regularity analysis to a matrix equation. Using results on the numerical range, we derive sharp regularity results in edge-type configurations.

The talk aims to give an overview of results given in the literature, improvement on those for the case of an edge, and future plans.

**Keywords**: Second order elliptic systems, Higher regularity, Mixed boundary conditions, Pencil operator, Numerical range