MAX-PLANCK-INSTITUT
FÜR PLASMAPHYSIK

Multipatch ????

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Solving Poisson with CONGA

We want to solve the Poisson equation

$$-\operatorname{div}(\nu \operatorname{grad} \phi) = \rho$$

using a the CONGA approach on a 2D multipatch domain.

- Have finite element space V_h with jump discontinuities across edges
- Subspace $V_h^c \subseteq V_h$ with functions conforming to some global regularity constraint
- Define projection $P_h : V_h \to V_h^c$ and discrete differential operator $\operatorname{grad}_h := \operatorname{grad} P_h$
- Discretize Poisson equation weakly using these operators

- Already implemented in Psydac and successfully applied to several problems.
- Probably easier to generalize to complicated geometries than other approaches like using different splines e.g.

Patch data – Exchange

- Mesh-points,
- Local sums to compute the derivatives at the interfaces thanks to this type of sum of spline values (Advection) (What is α, please check!)

$$\sum_{x_i \in \text{global space}} \alpha_i s(x_i) = \sum_{p \in \text{Patches}} \sum_{x_i \in p} \alpha_i s(x_i),$$

- Characteristic feet outside of the patch (Advection),
- Interpolated values for **A** and ρ (Advection).

Patch data – Storage

- Mesh points, dimension (`DimXi`, `DimYi`), mapping, `SplineBuilder`, metadata,
- Boundary condition of global domain if an edge of the patch is on the global boundary,
- Values of functions ρ, ϕ, $\mathbf{A}$ on mesh points,
- Spline coefficients of functions (ρ, ϕ, $\mathbf{A}$),
- Reference to global domain class.

Global domain

- Global domain class
  - References to patches,
  - ’Connectivity’ class which encodes the geometrical information.
- Connectivity class
  - Identify edges and corners of different patches (do we need to identify corners of same patch e.g. when it closes on itself?)
  - For T-joint, identify sections of edges with sections of other edges, place corners in the middle of edges.