MSRE MESH GENERATION

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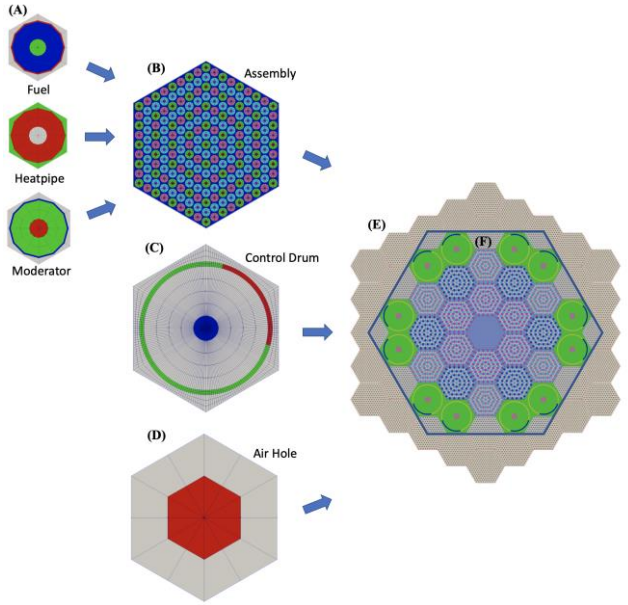
MESH SYSTEM & MOOSE REACTOR MODULE

Open Source Meshing Capabilities

- MOOSE mesh system is using MOOSE programmatic interfaces for “online generation” mesh generation
  - Manual: https://mooseframework.inl.gov/syntax/Mesh/
- MOOSE Reactor Module is an open-source reactor meshing capability that consists of a series of new mesh generators to enable meshing of reactor cores provides
  - Manual: https://mooseframework.inl.gov/modules/reactor/
  - Rapidly build up Hexagonal and Cartesian geometries with concise input. Can leverage advanced routines for more unique geometries.

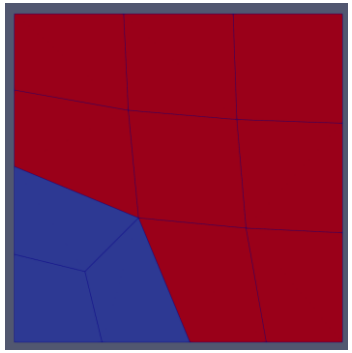


Empire heat-pipe cooled microreactor mesh with rotating control drums

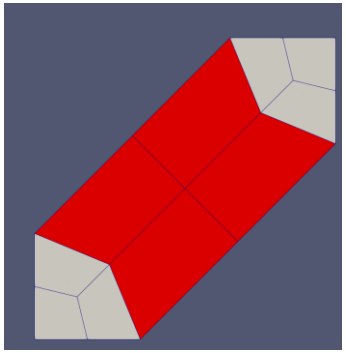
MSRE MESH: LATTICE

- MSRE heterogeneous model was created through stitching, transforming, deleting, and filling primitive components
- The MSRE mesh was generated using the combination of multiple MOOSE mesh generator objects, such as
    - ConcentricCircleMeshGenerator / PolygonConcentricCircleMeshGenerator
    - FillBetweenSidesetsGenerator
    - PlaneDeletionGenerator
    - StitchedMeshGenerator
- High flexibility of MOOSE mesh generation allows more than one way to generate the MSRE mesh
    - Alternative method: ParsedCurveGenerator + XYDelaunayGenerator

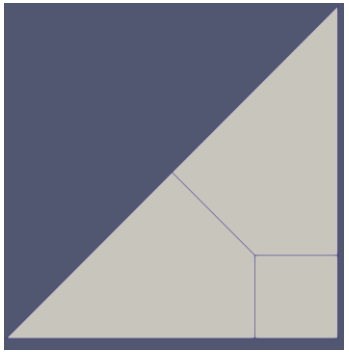
Circle + Depletion



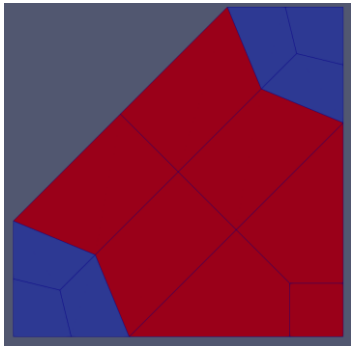
Fill between circles



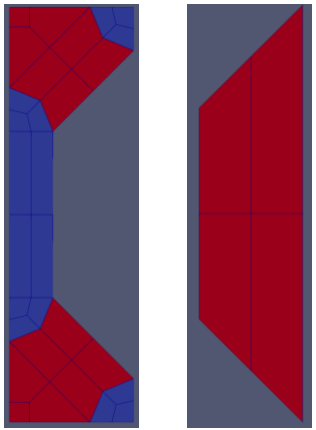
Polygon



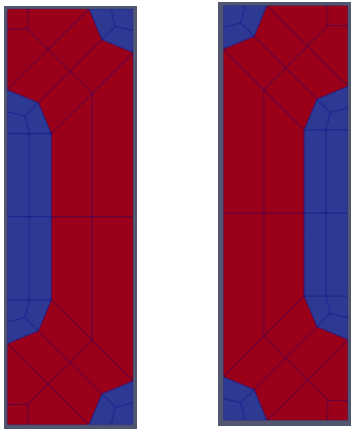
Stitch polygon and circles



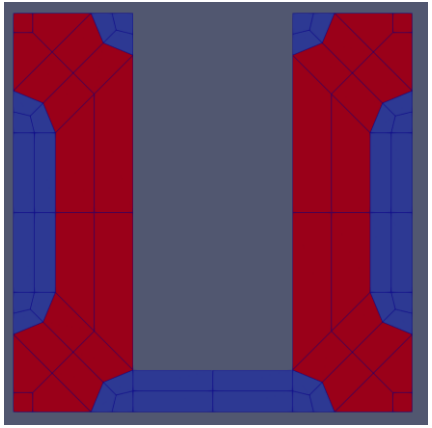
Fill area between two corners



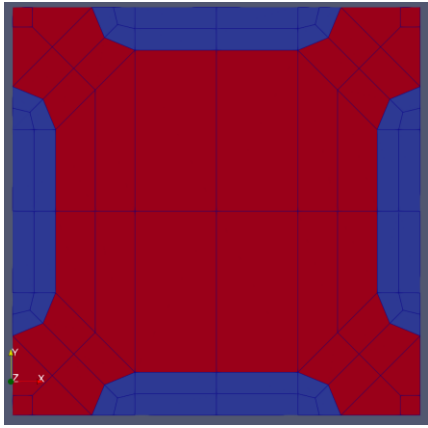
Mirror left side



Fill between left and right sides

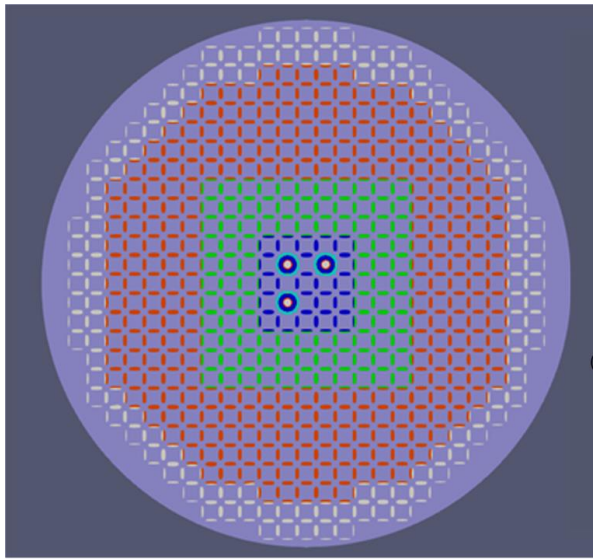


Final fuel lattice



MSRE MESH: CORE

- Core mesh was created as follow:
  - PatternedMeshGenerator to generate core lattices
  - Remove the central lattices
  - Create control rod lattice based on its surrounding boundary
  - Stitch control rod lattices together to generate the central control rod region
  - Stitch the central control rod region back to the core lattices.
  - PeripheralRingMeshGenerator to add the outer boundary
  - Extrude and scale.



PRACTICE PROBLEM

- Create a model with fuel lattice surrounding a control rod (withdrawn).
- Ideas:
  - Copy the fuel lattice generators
  - Create a PatternedMeshGenerator with fuel lattices surround a dummy lattice
  - Delete the dummy lattice and keep the boundary
  - Create control rod lattice
  - Connect control rod lattice with the fuel lattices.
  - Extrude and scale