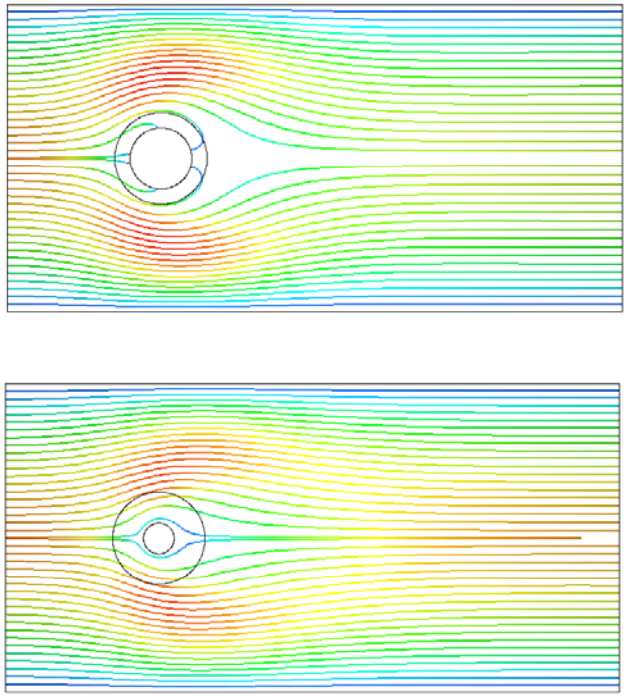
An embedded boundary method for the Navier-Stokes equations on a time-dependent domain



Flow past a shrinking sphere on 2:1 domain. Circles represent initial and final sphere surface. Curves are streamlines. Color corresponds to |u| from 0 (blue) to 1.7 (red). Note that the streamlines attach to the sphere in top figure because it is moving. Times are 0:6 and 1:2, respectively.

- In order to model precipitation and dissolution due to reactive transport in subsurface pore space an accurate and stable method is needed to simulate flow and transport in a time-dependent domain.
- We have developed a higher-order accurate algorithm for incompressible flow in moving domains based on the embedded boundary method. There are several advantages to this method:
  - The reactive surface area used in geochemistry calculations for reactive transport is exactly the area of the embedded boundary.
  - The method facilitates direct simulation from image data which is important to NCGC validation experiments.
  - This approach to fluid-mineral boundaries is consistent with the approach we take for fluid-fluid boundaries in multiphase flow.
- This algorithm will be implemented in the Chombo-Crunch production code that models pore scale reactive transport

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