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Problem Title: Fluid flow analysis using Naiver Stokes equation.

Problem Statement:

Fluid flow analysis is a crucial discipline in engineering and science that deals with the behavior of fluids (liquids and gases) as they move and interact within various systems. Fluids are encountered in a wide range of applications, from air flowing over an airplane wing to water flowing through pipes, blood circulating in our bodies, and even the movement of magma within the Earth's mantle. Understanding and predicting how fluids behave under different conditions is essential for designing efficient and safe systems in fields such as aerospace, automotive engineering, environmental science, and more.

The behavior of fluids is described by physical principles and mathematical equations. One of the most fundamental equations governing fluid flow is the Navier-Stokes equations. These equations are a set of partial differential equations that relate the velocity, pressure, and viscosity of a fluid to its behavior in space and time. The equations take into account the conservation of mass (continuity equation) and the conservation of momentum (momentum equations) for fluid elements.

Project Goals:

- Understand the theoretical foundation of fluid dynamics, including the Navier-Stokes equations and boundary conditions.
- Develop a CFD solver to numerically solve the Navier-Stokes equations using appropriate numerical methods.
- Validate the solver's results by comparing them with analytical solutions or experimental data.
- Investigate different fluid flow scenarios, such as laminar and turbulent flows, around objects and through channels.
- Handle boundary conditions appropriately with proper assumptions.
- Apply the solver to different fluid flow scenarios. For instance, simulate flow around a cylinder, through a pipe, or over an airfoil. Analyze and discuss the obtained results in terms of flow separation, pressure distribution, and other relevant parameters.