Implicit solvers for two phase flow with sharp interfaces

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Two-phase flow: Flow involving both gas and liquid, e.g., air bubble rising in water

Focus: Creation of a new phase, e.g. fast moving propellor in water tunnel (can cause severe damage)
Creation of a new phase

Use sharp interfaces

\[ t^{n+1} \quad \text{gas} \quad t^n \]

\[ x_{i0+1/2} \]

⇒ Results in tiny cells

⇒ need special treatment

⇒ new mixed explicit implicit scheme:
  - treat majority of cells using explicit time stepping
  - treat some cells using implicit time stepping
  ⇒ need to solve small implicit systems
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Situation:
  - New approach works better than what people use so far
  - BUT: the implicit solve sometimes takes longer than it should
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Situation:
• New approach works better than what people use so far
• BUT: the implicit solve sometimes takes longer than it should
⇒ Goal: improve that
**ToDos**

**Goal:** Test numerically and understand results
mostly 1d and matlab

1. Examine pseudo time stepping / read on new literature
2. Test more Newton-like approaches

**Necessary background:**
- Programming
- Time stepping schemes (Runge-Kutta schemes)
- Implicit solvers
- A course about numerics for PDEs (Finite volume)