

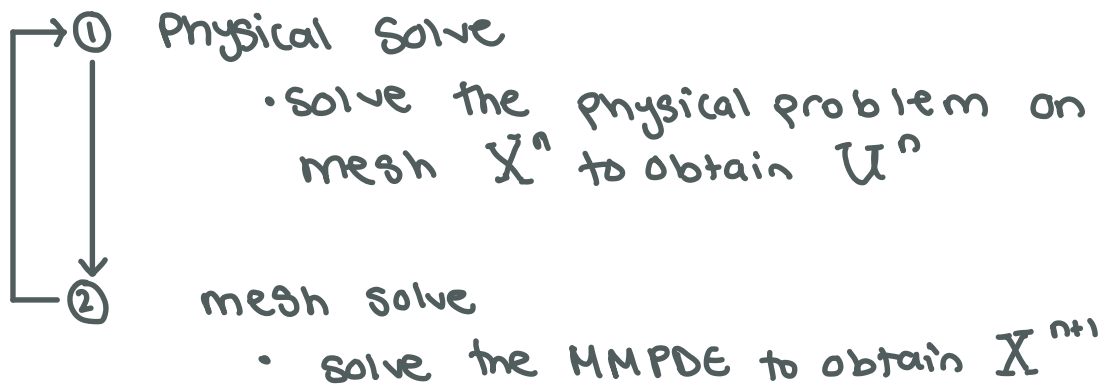
Summary of the Options for a Physical Solve and Mesh Solve Coupling

Option 1: $(PM)^n$ - Iteration

- In this option the iteration is between the Physical solve and the Mesh solve

inputs: starting uniform grid X^0

for $n = 0, 1, \dots$



The MMPDE: $\nabla (M(U^{n+1}) \nabla X^n(z, n)) = (0, 0)^T$

Option 1 Results

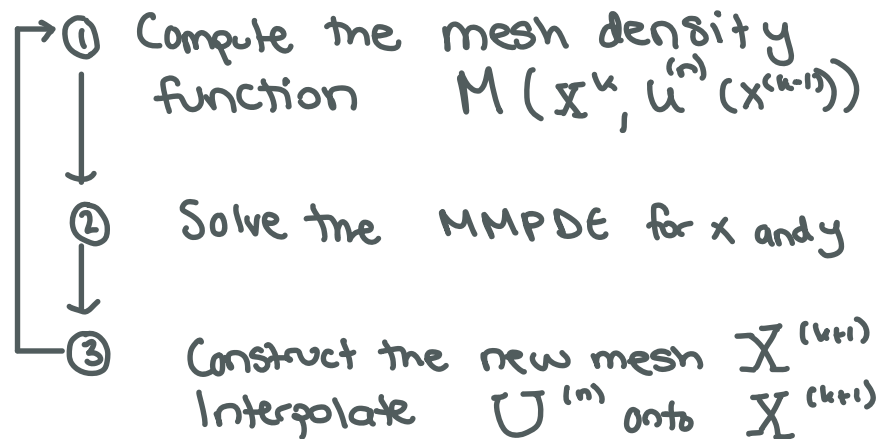
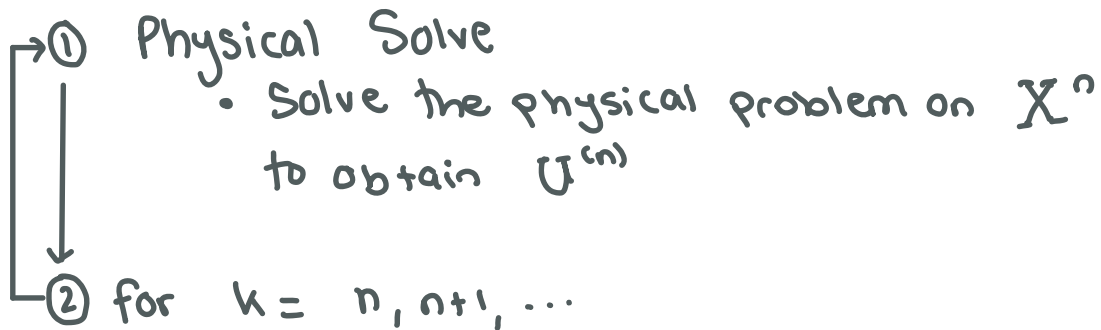
- This scheme works well and converges (according to Kopteva this makes sense)

Option 2: P + (M iteration) or (PM^k iteration)

- In this option the iteration is between mesh solves

inputs: the starting uniform grid X^0

for $n = 0, 1, \dots$



The MMPDE: $\nabla (M(U^{(n-1)}) \nabla X^n(z, n)) = (0, 0)^T$

Option 2 Results

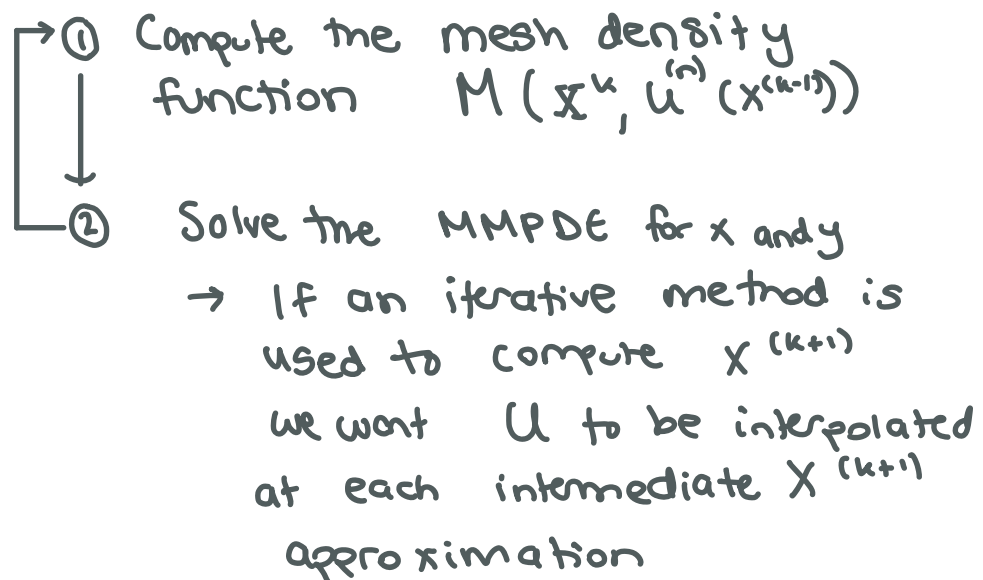
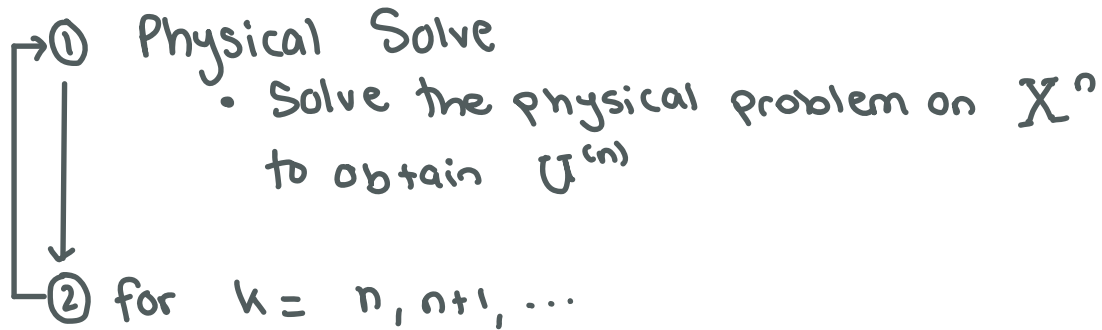
- We chose $M = \sqrt{1 + u_x^2 + u_y^2}$
- The iteration seems to work but diverges

Option 3: A different $(MP)^k$ iteration

- This iteration has the same overall structure as Option 2. However, in this iteration we hope to update U (and consequently M) at every iteration of the solver used in Fire Drake
- In the last option, M was behind by one $(M)^k$ iteration. In this option, M will be behind only by one solver iteration in a particular $(M)^k$ iteration

inputs: the starting uniform grid X^0

for $n = 0, 1, \dots$



Issues with this Option

- U depends on a mesh constructed from x and y solutions
- Consequently, U depends on the background mesh for the particular MMPDE solve
- For this option to work, we would have to be able to update the background mesh for every iteration of the built-in solver \rightarrow I am not sure how this is done.