Muddiest Points from Class 04/24

- *"Can you tell us more clearly how can I determine the steady state R? I just determine this by visualize the R(t) plot currently which makes me feel unreliable."*
  - You likely already store R(t) and t in 1D arrays for plotting: R(k) and t(k) with k the time step number
  - Simply evaluate discretely the steady state condition using first order backward finite differences with step size s

$$\left|\frac{dR}{dt}\right| < \epsilon \quad \Rightarrow \quad \left|\frac{R(k)-R(k-s)}{t(k)-t(k-s)}\right| < \epsilon$$

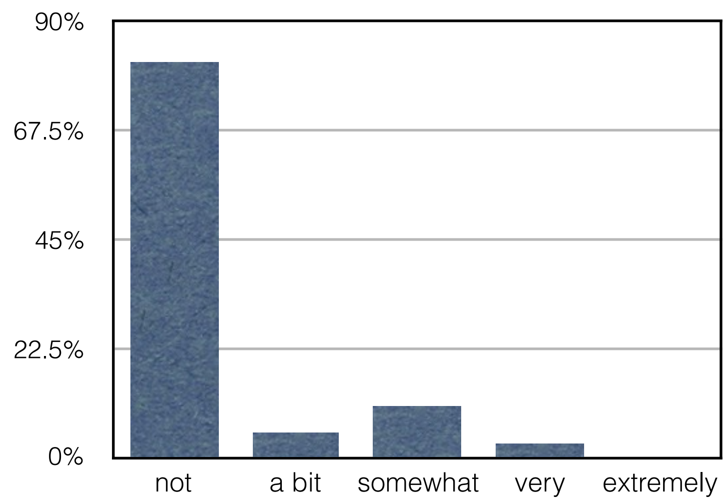
  - here k is the current time step number and s is the step size, for example 20 (or 50)
  - ε has to be small enough to not impact the spatial error analysis of GCI

- *"Since the GCI analysis this time really takes a long time, can I first calculate steady state R for each mesh separately like the table in bonus homework problem 6 and then do the GCI analysis?"*
  - I don't follow: the GCI analysis is quick, it's generating the steady state R values that is time consuming
  - Unless you have coded the GCI analysis as an outer loop in your actual code: DON'T DO THAT!!!
  - Have your code give you the solution for one mesh resolution and then transfer the data into a table for GCI analysis

- *"For the purposes of the final project do we have to implement one of the advanced boundary conditions? Or is the simple volume flux corrected extrapolation sufficient?"*
  - As stated in the slides: simple constant extrapolation is sufficient
  - The volume flux correction for the outlet has to be performed irrespective of the choice of outlet condition
  - One minor correction to the outlet boundary condition for the transverse velocity v: the HW10 debug file used Dirichlet conditions with v=0 at the outlet, a likely better choice would be zero Neumann. But: this does not impact the results to any significant degree, so either one is fine

- Muddiest Points from Class 04/24

  - *“However, in problem 6 of bonus homework #11, what does it mean when it asks for error bars on the solution? Aren't we only outputting a single solution point, what would be the purpose of graphing it with error bars?”*
    - The term error bars refers to providing the accuracy range Y of the solution as in X +/- Y%
  - *“Do we need to store the predictor velocities v* and u*? Or can we overwrite them?”*
    - No need to store them for the next time step, however you need them for the corrector/projection step
    - Also: the only quantity to store for each time step is R and t for plotting
  - *“Implementation of VCycle in final project.”*
    - See HW5 and associated slides.
    - The only things that must be modified is changing the j-direction loop index from M to N and the calculation routine for the number of grid levels to traverse (using `min(M,N)` instead of M)
  - *“for convergence conditions for V-cycle, for example, what exactly values of absolute value should I take? machine zero? or sth else?”*
    - machine zero would be overkill (and likely not reachable due to finite precision errors)
    - The value you choose must be small enough to not impact the GCI analysis of the spatial errors
    - the value does not need to be very small during the non-steady state evolution of the flow
    - when analyzing (plotting) the time evolution, the value shouldn’t be too large



- **Please fill out the course evaluation forms online!**

	responses	students	response rate
AEE 471	7	27	**25.93%**
MAE 561	24	46	**52.17%**

as of 04/25 10am

- Questions about the Final Project?