UQ breakout session

Slides from chair

- Overview of slot convection problem, description of UCL tools for UQ

Slot convection problem / general approach to UQ in NEPTUNE

- Parameter sweep for 2D problem (using FabNEPTUNE)
    - ET: Would be good to have a problem with more inputs to test "subspace" framework
    - PC: Also interesting to know the minimum number of runs you can get away with - that knowledge will be useful for Exascale
    - PC: Rule of thumb is 20 runs for 2 inputs, but depends on sensible sampling (Latin Hypercube, sequential design, etc.)
- ET: Nektar model already given to Tim Dodwell, happy to share with PC too
- Discussion of inputs (Ra, Pr), outputs (Nu) for surrogate, definition of Nu
- Grossmann-Lohse regimes
    - RA: What drives existence of different regimes?
    - ET: Whether transport is dominated by boundary or bulk, whether transport is turbulent or not
    - How many runs needed to look for regimes in Nektar sims?
    - Probably many more than the 20 that would be appropriate for coarse sampling
    - ET: Could statistics of velocity data could be used to discriminate between regimes?
    - RA: Machine learning algorithm could help there?
- Resources needed to run a sweep for 3D problem?
    - Some time still available in Archer2 allocation
    - May be practical using CSD3 (usage has been low over summer 2022; likely to change when students return)
- Considerations in constructing surrogates
    - Need to take care to avoid over-fitting
    - Always better to include any known physics constraints, correlations etc.
    - Approach would likely be, find regime boundaries (clustering??), then fit separate surrogates for different regimes
- Possible sources of Smallab/Nektar differences?
    - Smallab is open on viewing side; inconsistent with Nektar BC
    - Small scale imperfections in Smallab tank walls?
- What's the analagous problem in a Tokamak?

    - RA: Hot plate = LCFS, Cold plate = first wall

- Quite a bit of discussion on issues with trying to do UQ on full Tokamak problem
    - Numerous sources and sinks, many other complexities
    - e.g. inhomogeneous cooling by impurities; line-cooling dominates, sensitive to exact composition

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Smallab

- How do velocity measurements work?
    - DB: Track 10-micron, silver-coated glass spheres
- Experimental setup?
    - DB: Actively heated on one side; "passive cooling" through perspex viewing side
    - DB: Working on actively cooling viewing side; timeframe of ~ 2 months?
- Max Rayleigh number?
    - DB: Have achieved up to ~10^7
- Aspect ratio?
    - DB: 14.95
- Scope for larger-scale tank?
    - DB: Possibly, will depend on progress on current experiment

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DB: Dom Buta

ET: Ed Threlfall (Chair)

PC: Peter Challenor

RA: Rob Akers