Project outline for presentation, etc.

**Introduction**

* Vortex Modeling: This should just be an overview of vortex methods – just a little introductory stuff
* EnsembleKF: Why use this (as per the authors) and it’s potential advantages over other schemes.
  + From the “understanding paper”
  + A text on a page

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* What makes this problem interesting? As we’ll see later:
  + We can formulate nonlinear mappings of states to measurements in the EnKF formulation by including the measurement as the state

**Goals and approach:**

* Investigate if it’s possible to estimate the vorticies based on the pressure distribution using an EnKF
  + How to derive the filter
  + What parameters make a successful filter
  + And what are the implication of using this in real time?

Time stepping, f: From the paper, at each time step

1. For every possible source-target pair of vortex blobs in the model, use Eqn. (17) in Darakananda and Eldredge6 to compute and store the hypothetical velocity correction to the target required if all of the source’s circulation is transferred into the target.
2. Compute the (uncorrected) velocities of all vortex blobs and evolve the system forward by one time step.
3. Compute the impulse for each vortex blob at this end of this step
4. For every possible source-target pair of vortex blobs in the system, first determine, from the velocity correction computed in step 1, the hypothetical impulse that the target blob would have if it had absorbed all the circulation from the source blob. Subtract from this the actual impulse of the source and target blobs, computed in step 3. This difference, when divided by time step size, is defined as the transfer error, and is a measure of the spurious force on the plate due to the aggregation.
5. Sort the source-target pairs based on the magnitude of their transfer error.
6. Starting from the pair with the lowest error, transfer circulation between as many pairs of vortex blobs as possible, stopping just before the accumulated error exceeds eps\_F.

Application to vortex model:

* State vector
* F – which is kind of like above
  + Q: how do we go from blobs to measurements?
* Problem: measurements are not linear transformation of states
  + Sol’t we must augment
* Step through the EnKF derivation

**Experiments and Results: 4 cases in each experiment:**

* No inflation
* Multiplicative inflation
* Additive inflation

Focus first on no pulse actuation: Show figures 10-13 first.

Then show the figure below – the results require covariance inflation. This should be a summary slide of the figure 10-13.

A screenshot of a graph

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So, we’ve now shown that, qualitatively, the filter works OK. Figures 4-7

# of partices: figure 4

Make comments on covariance inflation – the EnKF does not use information about the process noise when comuting the ensemble covariance. Therefore, when there is nonzero measurement cov, P- will be ever decreasing and you will only rely on the model. Therefore, cov inflation is used here to “smooth” out the estimate by accepting measurements. Otherwise, you get cross-crossing from the discrete

What about the other two cases?

One pulse case: Figure 14 to show qualitative results + force on plate

Two pulse case: Figure 24 + force on plate

For the appendix: the covariance plots and the number of particles

Future Work:

Investigate using other methods of approximating the flowfield (ex, discretizing and solving over the mesh itself so you don’t have to do the augmentation in the EnKF. Need to beat out 50 pts \* number of blobs in each point \* meas points + computational burden of computing f).

Explore methods of conserving the number of ensembles to ensure a method can be taken online (ex, how long do we need to keep a blob in the simulation?)