IMPERIAL

Jeff update

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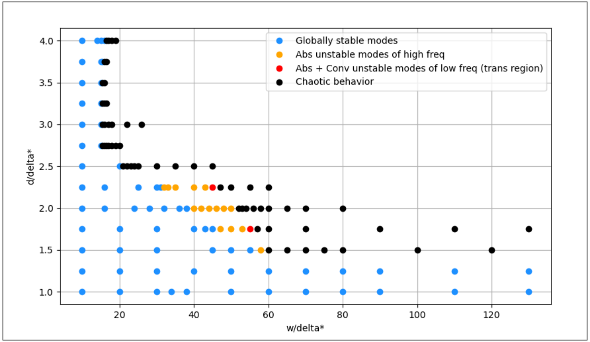
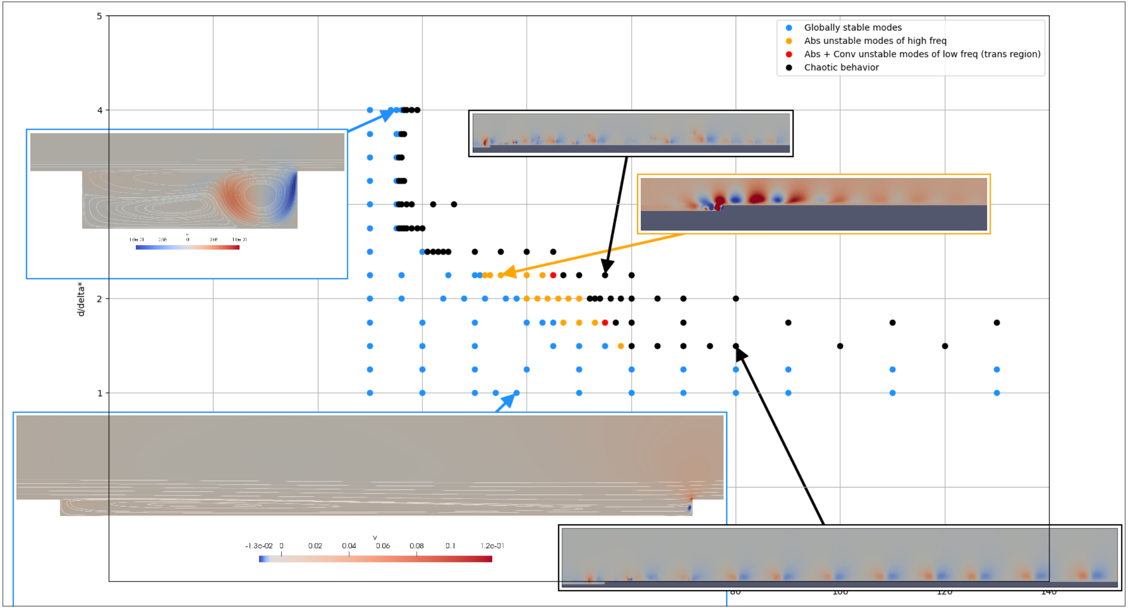
Stability analysis diagram

- So far everything is 2d + incompressible.
- Orange means there is an absolute instability in the downstream edge of the gap.
- Usually that absolute instability has high temporal frequency which lies much above the upper limit of the neural curve (of convective instability) for the blasius profile (see figure below). We still need to check this more rigorously with SPOD.
- The red is the transition region, where some small enough frequencies are excited near the absolute instability region, which then grow downstream due to the convective instability. May not be 100% accurate right now, but roughly.



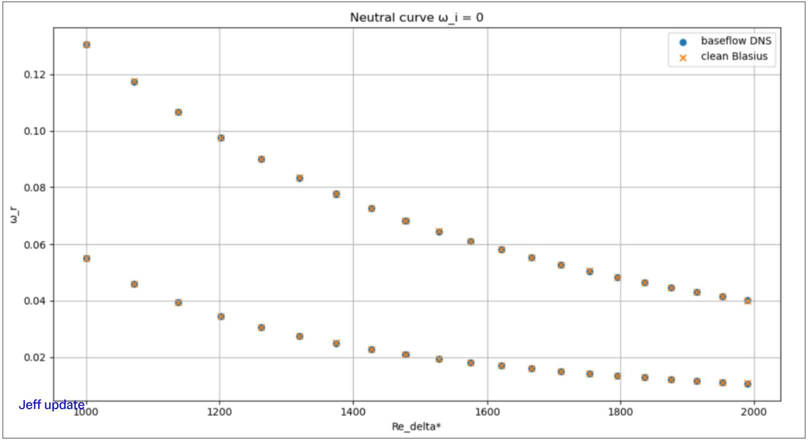
Check next slide to see figures (all representing the v component of the velocity) in some cases.



Globally stable modes
Abs unstable modes of high freq
Abs + Conv unstable modes of low freq (trans region)
Chaotic behavior
d/delta*
5
4
2
1
80
100
120
140
v
-1.3e-02
0
0.02
0.04
0.06
0.08
0.1
1.2e-01

Neutral curve for Blasius profile

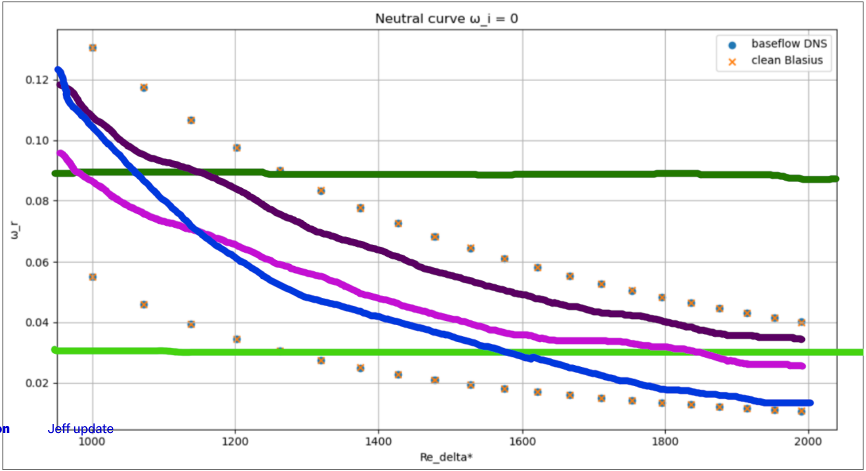
- This is orr-sommerfeld analysis for the Blasius profile and for different profiles (varying x location) of the flat plate baseflow from DNS. They match pretty well.
- Increasing Reynolds = moving downstream in the domain.
- Neutral curve is for the growth rate of the TS mode, y-axis is the temporal frequency of the waves.



Ways to compute the n-factor

- As we commented last time, we were unable to obtain the TS mode using our ‘default” EV finder (which founds the EVs with greatest real part). We tried another one, which should find the eigenvectors with eigenvalues closes to the origin, but it didn’t work either (in this case, due to software problems, not physical ones).
- Then, we tried blowing and suction, which partially worked. By partially I mean that we were able to excite the TS mode, but they become damped at some point further downstream (see picture next slide).
- Now we started trying with transient growth in the flat-plate case and the results are promising.

- When blowing an suctioning at the same frequency (green) there are times when the TS mode are damped (bad). The ideal case would be to follow any of the purple curves (even more ideal, the centered one, corresponding to the most unstable frequency at any position), that is, getting the TS modes for a frequency inside the neutral curve and follow them downstream NATURALLY, as opposed to the blue curve.



N-factor

- The N-factor for several transient growth (TG) analysis.
- The result of TG is an the optimal initial condition giving the maximum energy at time τ. Plot below shows TG for $\tau = 450, 900, 1200$.
- Transient growth give us a wave packet that grows as it moves downstream (figure on the right).