

Addendum and clarification for Task 2 and 3, Project 4

This is to summarize what we discussed in class on Tuesday (Nov 21) and provide an additional (and unrelated) clarification on Task 3a.

(1) In Task 2 and 3, the original problem statement asks that only *steady solution* be sought. Under that setting, each run is expected to produce one value of lift or drag. Early (and yet to be confirmed) feedback indicates that some of the tasks in Task 2 & 3 might still be in the oscillatory regime. If so, a *transient* simulation for the task would have produced time-varying lift and drag, much like the classical example of flow passing a circular cylinder under intermediate values of Reynolds number. Running “steady solution” for the task will lead to fluctuation of lift and drag with the number of iterations. Different values of lift or drag can be produced depending on when one tops the iteration. This is akin to picking the value of lift or drag at a particular phase of an oscillation from a transient simulation.

(2) We had designated the “steady solution” setting for Task 2 and 3 due to limited time, given that transient simulations (particularly those for the 3-D case) take longer to complete. Nevertheless, in light of (1), the “steady solution” setting may produce a range of values, instead of a unique value, of lift/drag. This raises the question as to what answer would be acceptable.

(3) As a resolution to (2), we suggest the following:

(i) It is perfectly fine to switch from steady to transient solution for any of the tasks under Task 2 and 3. **In that case, instead of presenting a single value of lift/drag, one can either show the plot of the time series of lift/drag, or present a single value of lift/drag as the average over one cycle of oscillation.** For Task 3b (MAE 598 only), in the line plot of the lift/drag as a function of tilt angle, each data point should represent the average over one cycle of oscillation. Of course, this is provided that any of the cases actually exhibits an oscillatory behavior. If the value of lift/drag approaches a steady value with time, there would be no need to do any phase averaging.

(ii) For those who have limited time, it is also fine to just run steady solution for the tasks under Task 2 & 3. In that case, it is recommended that sampling (at different “stops” of iteration) and “phase averaging” similar to that described in (i) be performed. The single value of lift/drag given in the answer will be the averaged value.

(4) With the suggested practice in (i) or (ii), after phase-averaging the values of lift/drag should become much more consistent across the solutions provided by different students. Then, we should have a reliable scheme to grade the answers. If approach (ii) is chosen but no phase-averaging is done (i.e., the value of lift/drag is taken from only one particular “stop” of

iteration), the result will still be acceptable as long as that single number falls within a reasonable range of the anticipated oscillation. (The benefit of doing the averaging is that it increases the probability for one's answer to be closer to the middle, i.e., the safest, ground.) Due to time constraint, we will be reasonable in giving credit to answers that are "close enough".

(5) The points in (2)-(4) are concerned with the presentation of lift and drag. For the contour plots of the flow fields, for each deliverable it suffices to present a single plot taken from any phase of the oscillation (if there is an oscillation).

Additional clarification:

In Task 3a, deliverable #3 is "Contour plots of x-velocity and static pressure along the plane that passes through the origin and is perpendicular to the plane of symmetry". As it turns out, there are *two* planes that pass through the origin and are perpendicular to the plane of symmetry. We clarify that **the plot should be made along the plane that has a rectangular cross section**, not the one that has a circular cross section.