* Abstract
* Intro
  + Why is delta wing flow important?
  + What are the characteristics of flow over delta wing?
  + What was aim of this study?
  + Outline of report structure
* Model Setup
  + Geometry
    - Wing designed to be close as possible to NASA medium radius leading edge delta wing used by Chu and Luckring. Used same leading/trailing edge radius and leading/trailing edge length
    - Geometry chosen as it is well defined in the paper and according to Cummings et al larger radii on leading edge leads to a more symmetric flow which makes symmetrical modelling more appropriate.
  + Boundary Conditions
    - VOF methods dismissed as too expensive
    - 2D test case set up to test what combination velocity and pressure boundary conditions worked best
    - 2D rectangle, inviscid flow, same wave height and period as design case, tried combinations of defining pressure and velocity field function or slip wall on 4 sides, compared simulation to analytical flow field
    - Only errors seemed to be near pressure boundary so best method was deemed to be to have velocity defined at inlet, top and bottom and pressure at outlet, as long as far enough downstream it shouldn’t affect flow over the wing
  + Mesh
    - Polyhedral chosen as high aoa means flow close to wing would be badly aligned with a trimmer mesh, additionaly polyhedral meshes are particularly good at capturing regions of recirculation due to their many edges and sudo random orientation, cite CCM+ paper again.
    - Values chosen with finest grid in mind, then base size scaled up 4x to make coarse grid which was then refined to make the medium and fine grids
    - Sizes for fine grid:
      * Surface size on wing set to 2% of chord, mesh size at wing edge dictated by surface curvature, 36 pts/circle
      * Prism layer designed to have good y+ value and grow until same volume as freestream cells. First cell height chosen as 3.8e-5 m , and final layer height as 0.0013 m which is 65% of defined surface size of 2% of chord, this gave good volume ratio between prism and freestream cells. (show cut cell picture and/or Y+ histogram)
    - Surface size at boundaries allowed to grow to 4 times chord, surface growth limited to 1.2
    - Coarse grid created with all sizes 4x larger and only 6 prism layers, then medium grid created using one stage of refinement and 13 prism layers and fine mesh with two refinement stages and 25 prism layers
  + Physics Models
    - Incompressible
    - Implicit unsteady, flow field contains two primary timescales, that of the waves and that of the delta wing vortex shedding, based on strouhal numbers presented by Gordnier, time period of vortex shedding is approx. 0.01s capturing this would mean ~400 timesteps per wave eriod and therefore not practical given that flow will take multiple wave periods to settle to a steady oscillation. Focus of unsteady simulation is therefore to see the effect of waves of forces, not vortex shedding. Time step chosen as 0.04, 1/20th of wave period, simulations carried out with double and half timesteps showed negligible difference in force coefficients. 2nd order timestepping used as it gives increased accuracy and did not run any slower.
    - Technically design is below critical Reynolds number for airfoil but combination of high angle of attack and wave field mean that actual flow would be turbulent. KW SST chosen as neither SA nor KE can deal with large recirculation regions. Turbulence was specified with an intensity of 15% and a length scale of 5mm (have p2p wave amplitude) at the surface and both decreased at the same exponential rate as the velocity and pressure field functions.
  + Segregated solver as incompressible
  + All simulations were run as a steady state model for 100 iterations to provide the initial conditions for the unsteady simulation.
  + All the final simulations were meshed, initialised, run and had data exported using a single batch file, created around 8000 csv files which were then processed using Matlab.
* Results
  + Force Coefficients, averages and variation
  + Vortex structure
* conclusions