Aeroelasticity M2795.005900

Mid-Term Examination

October 27, 2016 14:00 – 15:20 PM

1. (8 Points each) Explain the following instability phenomenon found in the static aeroelasticity, **without** trying to derive any mathematical details.
   (a) Torsional divergence
   (b) Control surface ineffectiveness (reversal)
   (c) Effect by the wing sweep angle
   (d) Effect by the rolling motion of the aircraft
   (e) Aeroelastic tailoring by applying composite materials

2. (8 Points each) In the process of deriving the governing equation for unsteady flow near the moving wing (or airfoil), the following theorem, equation, condition, or transformation are used. Explain briefly each of those **without** trying to derive any mathematical details.
   (a) Laplace's equation for velocity potential function (Ideal fluids)
   (b) Flow tangency at the solid surface (No flow through the solid surface)
   (c) Kutta condition at the trailing edge
   (d) Helmholtz vortex theorem
   (e) Glauert transformation

3. (5 Points each) For the analytic unsteady aerodynamic formulations other than Theodorsen's function, each formulation is related with Theodorsen's function $C(k)$ in a certain way. Briefly explain the reason why such relationship is introduced and how the relationship is described in each following function.
   (a) Wagner's function
   (b) Sears' function
   (c) Kussner's function
   (d) Loewy's function