AA200A Homework 2 2014 -2015

Due Thursday April 16

Read: Chapter 2

Chapter 2 - Problems 1, 4, 6 and 12

Use some basic physics to help your analysis. Check the solution using the web if you wish but try to work the problem using dimensional analysis first.

In problem 2.6 try to list the governing parameters of the problem and use the procedure for generating dimensionless parameters given in Chapter 2 before applying the approach suggested in the *Hint*.

In addition answer the following problem.

Problem - The figure on the right shows the scaling of weight (newtons) versus wing loading (newtons per meter squared) for a wide variety of birds from the common tern (about 1 newton) to the wandering albatross (about 90 newtons). The dimensional argument used to derive the relationship is the following: Let the wingspan measured tip-to-tip with the wings fully outstretched be called b. The wing area is proportional to b^2 and the bird weight is proportional to b^3. The wing loading W/S is therefore proportional to b which is proportional to the cube root of the weight W. Thus one can expect the wing loading and weight to be related by a power law of the form

$$W/S = CW^{1/3} \quad \text{or} \quad Ln(W/S) = Ln(C) + (1/3)Ln(W)$$

where C is a constant. The correlation shown in the figure is pretty good but not perfect and there is a fair amount of scatter. What are the main assumptions needed to arrive at this result?