Lighter-Than-Air Systems
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Lecture – 53
Tutorial Problem 11 on Pressure Height Calculation

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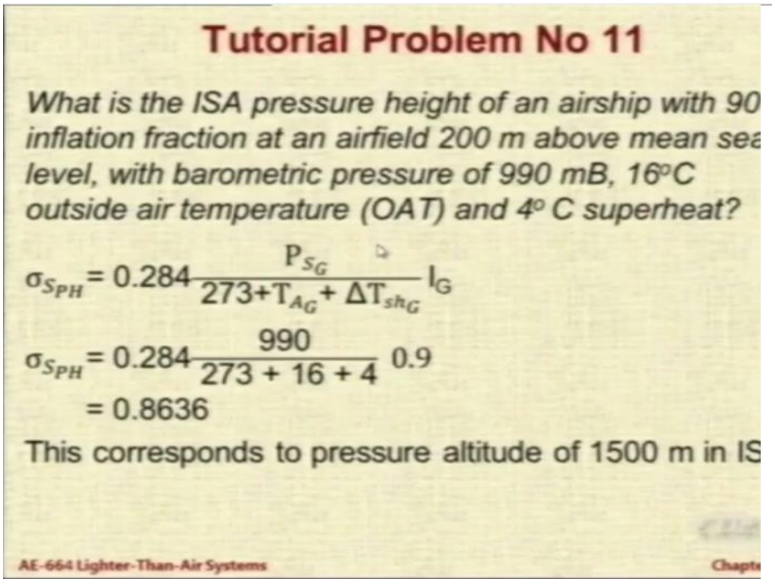

So, if you have understood this let us try out a small problem, very very simple problem. So, we have an airship which has got a 90% inflation fraction at an altitude which is located 200 meters above mean sea level. The barometric pressure recorded at that place is 990 mB. So, instead of you know 101,325 it is 990,000. Temperature is 16 degrees centigrade and superheat is 4 degrees. These are the observations. So, with this you have to now tell me up to what pressure altitude can this airship be operated? So, let us see how will you get to the value?

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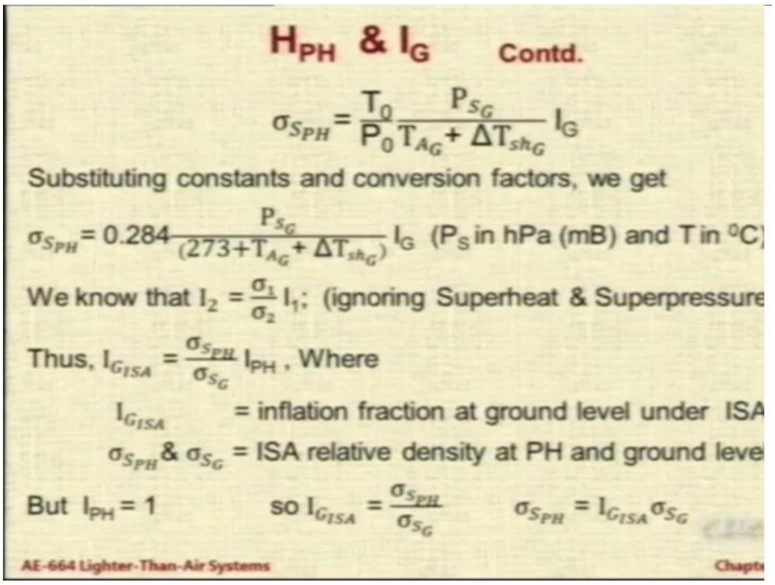

I will show you the equations once again. These are the equations that are available with you. So, what is the value of I_G in this example. Inflation fraction at ground level what is the value, anybody can tell me? Look at the question. So, what is I_G? I_G is not 1. Amruta what is the value of I_G? It is 0.9, yeah it is given there. So, the inflation fracture is 0.9 at the ground level.

So, now you know the value of I_G. Now what about P_{SG} pressure at the ground level? It is given as 990. Then what is the value of T_0, P_0 you know already, this ratio itself you know. T_{AG} is 16 degrees centigrade. So, it is 273 plus 16 and ΔT_{SG} is 4 degrees that is the superheat. So, you can get an array of σ_{SPH} from this expression, how much is that? This is what I got, you can cross check, correct.

So, now we have to look at the atmospheric tables and find out at what altitude is the density ratio equal to 0.8636. Does anybody have any textbook which contains the atmospheric ratios? If not I just tell you that this corresponds to 1500 meters under ISA conditions. So, this airship can fly up to an altitude of 1500 meters above mean sea level and the ground level altitude is 200 meters above mean sea level.

So, the ΔH it can go is only 1200 meters. So, in this question the data regarding the airship altitude is actually frivolous data. It plays no role. It would have played a role if we were told that under ISA conditions at 200 meters in which case the OAT would not have been given and the pressure also would not have been given because those can then be calculated for the ISA conditions using the relationship $\frac{P}{P_0} = \left(\frac{T}{T_0}\right)^{5.453}$ and T = T_0 minus lapse rate into the altitude.

But in this question the height above the mean sea level was given. However, at that place the conditions are not equal to ISA. Therefore the actual pressure and the actual temperature was given, correct? So, you can use these to get the altitude at which the airship is safely permitted to operate.