Indian Institute of Science

Design of Photovoltaic Systems

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NPTEL Online Certification Course

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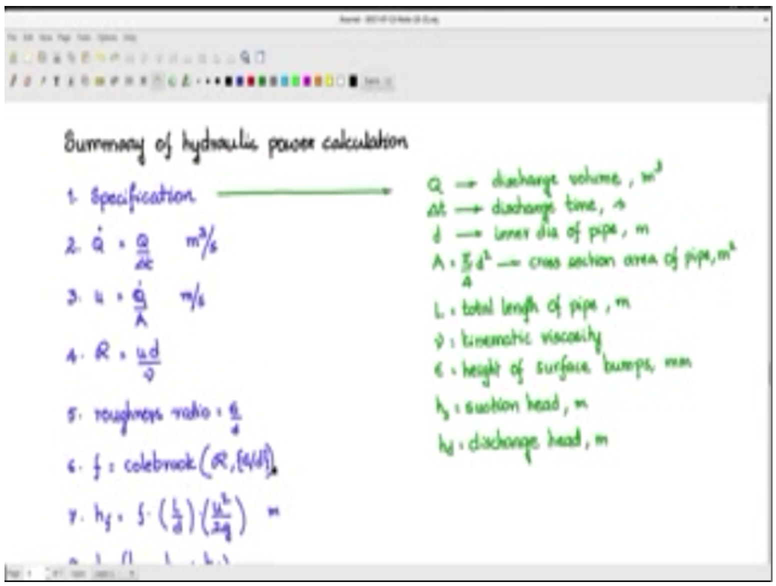

In order to make our task easy for calculating the hydraulic power we have so many steps, we have 1, 2, 3 up to 10 steps to that we need to pass through in order to obtain the hydraulic power and put them in a octave script file, I will just explain that and then I will leave it to you to explore it and I will also keep that script file in the resources section.

So I have here this a text file, look at the name hydraulic_power.m, it is a m file that can be opened in octave and run in octave. You can also probably use it in matlab with the minor modifications and syntax, but essentially it should be able to work well in octave. So this file calculates the hydraulic power required to pumped water, clearing all the variables, I have broken down the script into 3 main parts.

The first part is specifications, you have to give the input specifications taken from the field and the users. Then there are some unit conversions, you see that not all the input specifications are in SI units that is because the user is conversion in a particular set of units that is because the user is conversant in particular set of units like has I said the discharge volume even though we need to finally express in m^3 and use the formulas various equations in IS units the input has is in the form of liters for discharge volume sometimes.

It is in the form of liters /s for the discharge rate the lengths like the suction head delivery head or most of the time given in feet and the diode of the pipe carrying the water is given most of the time in inch so these are what you would call common usage so getting the user inputs in the common commonly used units in that neighborhood you take it and do the conversion you will add it to the unit conversion such that everything is expressed in SI units and then you apply the hydraulic equations then I have a 4^{th} part.

Which that displays, so you display run the results in a appropriate form, so let me just explained to you this script so that it will convenient for you to use when you when you want to exploit so I have here QL, QL is the discharge volume in leaders is most of the time we get value in leaders DT is nothing but ΔT it is the time discharge time dia is the inner diameter of the pipe it is normally given in inches so you have to convert it to meters Lf is the total overall length of the pipe including the horizontal part vertical and the horizontal part, vertical.

And the horizontal part, ν is the kinematic viscosity you will have to look into the science tables it is a function of temperature so at 20°C it is $1x10^{-6}m^2/sec$ at 50°C I mentioned earlier it is $0.55x10^{-6}m^2/sec$ so look into the science tables to get the kinematic viscosity value, ε is the height of the surface bumps hfs is the subsection head given in feed, hdf is the delivery head given in feed g is of course the acceleration due to gravity and row is the density of the fluid here it is water which is 1000 kg/m^3.

now we come to the unit conversions so in unit conversions Q that discharge volume has to be converted from liters to meter cube so it is QL which express in liters by 1000 will give you discharge volume in meter cube d is the inner diameter you take the value which si given in inches into 25.4/1000 will convert it into meters.

The area is $\pi d^2/4$ if you take the value d in meters then a will be mater square the total pipe like encoding the horizontal part which is given by Lf in feet convert it into meters by multiplying with the factor 12*25.4/1000 hs the section head in meters would be h_{sf} section head heat into

12*25.4/1000 likewise for the delivery head, you want your converted units now everything is in the SI system units.

You can now apply the hydraulic equations Ed e is the roughness ratio = ε/ d and d if it is in meters multiply it with 1000 to express it in mm because ε is a mm and express d also in mm to get the roughness ratio. Q. is Q/dt if you use Q in m^3 then Q/dt will be per second, u is Q./a then r Renaults number which is u x d/ μ. Once you have all that you can now use the Colebrook function which we developed earlier to obtain the friction factor input to the Colebrook function with number and the roughness ratio.

Once you have the fiction factor you can obtain the head due to the fiction loss using the equation f.lydu^2/2g once the head due to fiction loss is obtain which is delivery head +suction head+ head due to fiction loss all expressed in meters then the hydraulic power the σ.g.q. total dynamic head so in this way you can streamline.

The process of designing or obtaining estimating hydraulic power by appropriate scripting in octave and then you can output the value you want to see so I have used f print f and first the specification all the variables are related to specifications in the user units and the SI units both you can express so that you will be able to compare and then hydraulic variable like the toughness ratio the discharge rate fall in SI units fluid velocity number fiction factor and due to the fiction losses total dynamic head hydraulic power.

And so all these things can be obtained just in for the bore well that example that we just now discussed I have put in those values here and all I have to do is hydraulic power I will run that you will get the output you see that we have calculated something around 6000 watts hydraulic power requirement that is what you want you have the various parameters been displayed here so I will leave this to you I will leave this script file in the resources session you are free to explode it and then try to apply it and find out the hydraulic power for various installation.