

MADHAV INSTITUTE OF TECHNOLOGY AND SCIENCE
GWALIOR (M.P.)



REPORT ON
“CREATION OF MOODY’S CHART”

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Submitted by

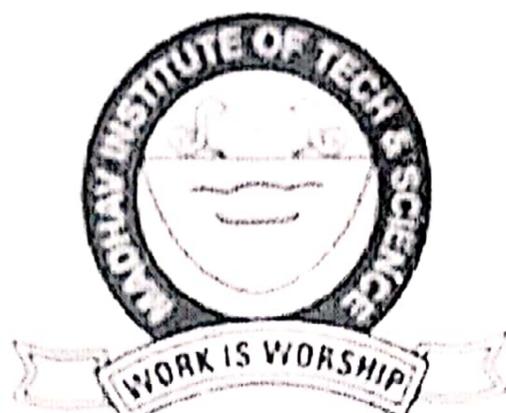
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Abstract

In this report, we have explained about how to generate Moody's Chart with the help of raw data provided/collected. Here we have covered the applications of Moody's Chart and uses as well. We also run our programme over MATLAB and the same is attached here under as well.

We are heartily grateful and thankful to our guide and advisor Prof. Anish P. Jacob sir who helped us in every steps.

Keywords : Moody chart , Applications , Programme , Matlab , uses

1. Introduction of Moody's Chart

The Moody chart or Moody diagram (also Stanton diagram) is a graph in non-dimensional form that relates the Darcy–Weisbach friction factor f_D , Reynolds number Re , and surface roughness for fully developed flow in a circular pipe. It can be used to predict pressure drop or flow rate down such a pipe.

1.1) Why do we use moody chart ?

Moody Chart (or Moody Diagram) is used to estimate the friction factor for fluid flow in a pipe. The chart represents friction factor as a function of Reynolds number and the ratio between internal pipe roughness and pipe diameter, or relative roughness, ϵ/D .

The Darcy Weisbach equation is commonly used for calculating pressure drop in a pipe due to friction, otherwise known as major losses. One of the terms in the equation is the Darcy friction factor. Friction factor is an empirical term that can be determined by solving complex formulas or by simply looking it up on a Moody chart.

Although using a Moody chart is easier to use for one-off calculations, it is not always useful for repetitive calculations or automation of pressure loss calculations due to the need to interpret values from a chart.

2. Matlab

CURRENT FOLDER

WORKSPACE

```

Moody.m frictionFactor.m JSONConversionUtility.m
1 clc;
2 tic
3 % Relative roughness vector
4 K = [0 1e-6 5e-6 10e-6 50e-6 100e-6 200e-6 600e-6 ...
5       1e-3 2e-3 4e-3 6e-3 8e-3 10e-3 15e-3 20e-3 40e-3 50e-3];
6 % Reynolds numbers vector
7 R1 = [4e3:1e5:1e4];
8 R2 = logspace(4,8);
9 R = [R1 R2] % The Reynolds numbers used
10 L_K = length(K); % length of the vector
11 L_R = length(R); % length of the vector
12 f = zeros(L_K,L_R); % Preallocate friction matrix
13 for ii = 1:length(K) % Loop through all the relative roughnesses
14     hold on % Plot on top of each plot
15     % Friction factor matrix from Colebrook see attachment
16     f(ii,:) = colebrook(R,K(ii));
17     plot(R,f(ii,:)) % Plot friction factor vs. function of Re
18     % Plot loglog
19     set(gca, 'YScale', 'log')
20     set(gca, 'XScale', 'log')
21     % Labels
22     xlabel('Reynolds Number')
23     ylabel('Friction Factor')
24     % Limits
25     ylim([0.0055 0.1])
    
```

COMMAND WINDOW

CURRENT FOLDER

WORKSPACE

```

Moody.m frictionFactor.m JSONConversionUtility.m
18 set(gca, 'YScale', 'log')
19 set(gca, 'XScale', 'log')
20 % Labels
21 xlabel('Reynolds Number')
22 ylabel('Friction Factor')
23 % Limits
24 ylim([0.0055 0.1])
25 xlim([600 1e8])
26 % Places the relative roughness text the line ends
27 xlim2 = get(gca, 'xlim2'); xmax = xlim2
28 txt = num2str(K(ii));
29 text(xmax, f(ii,end), txt)
30
31 end
32 % Plots the laminar region
33 Re_laminar = 600:100:2300;
34 f_laminar = 64./Re_laminar;
35 plot(Re_laminar, f_laminar)
36 % Places a red box in the transition region
37 h=fill([Re_laminar(end),4e3,4e3,Re_laminar(1)], ...
38       [f_laminar(end),f_laminar(end),f(end,1)], 'red');
39 h.FaceAlpha=0.3;
40 grid on
41 % Places the relative roughness axis title
42 xlim3=get(gca, 'xlim3');
43 ylim3=get(gca, 'ylim3');
44 h = text(xlim3/2,ylim3/2,'10e-3');
    
```

COMMAND WINDOW

```

% Places a red box in the transition region
h=fill([Re_laminar(end),4e3,4e3,Re_laminar(end)], ...
      [f_laminar(end),f_laminar(end),f(end,1),f(end,1)], 'red');
h.FaceAlpha=0.3;
grid on
% Places the relative roughness axis title attempt
xlim3=get(gca,'Xlim');
ylim3=get(gca,'Ylim');
ht = text(xlim3(1)+0.05*xlim3(2),ylim3(1)+0.8*ylim3(2),'Relative Roughness ');
ht2 = text(xlim3(1)+0.008*xlim3(2),ylim3(1)+0.2*ylim3(2),'Turbulent Region ');
% Places the text for the laminar region
ht5 = text(0.5*xlim3(1)+0.000008*xlim3(2),0.6*ylim3(1)+0.7*ylim3(2), 'Laminar ');
set(ht5,'Rotation',-72.5)
% Places the text for transition|
txt = 'transition';
text(1300,f_laminar(end)-0.003,txt)
title('MOODY CHART: Friction Factor(Relative Roughness,Reynolds Number)')
hold off
toc

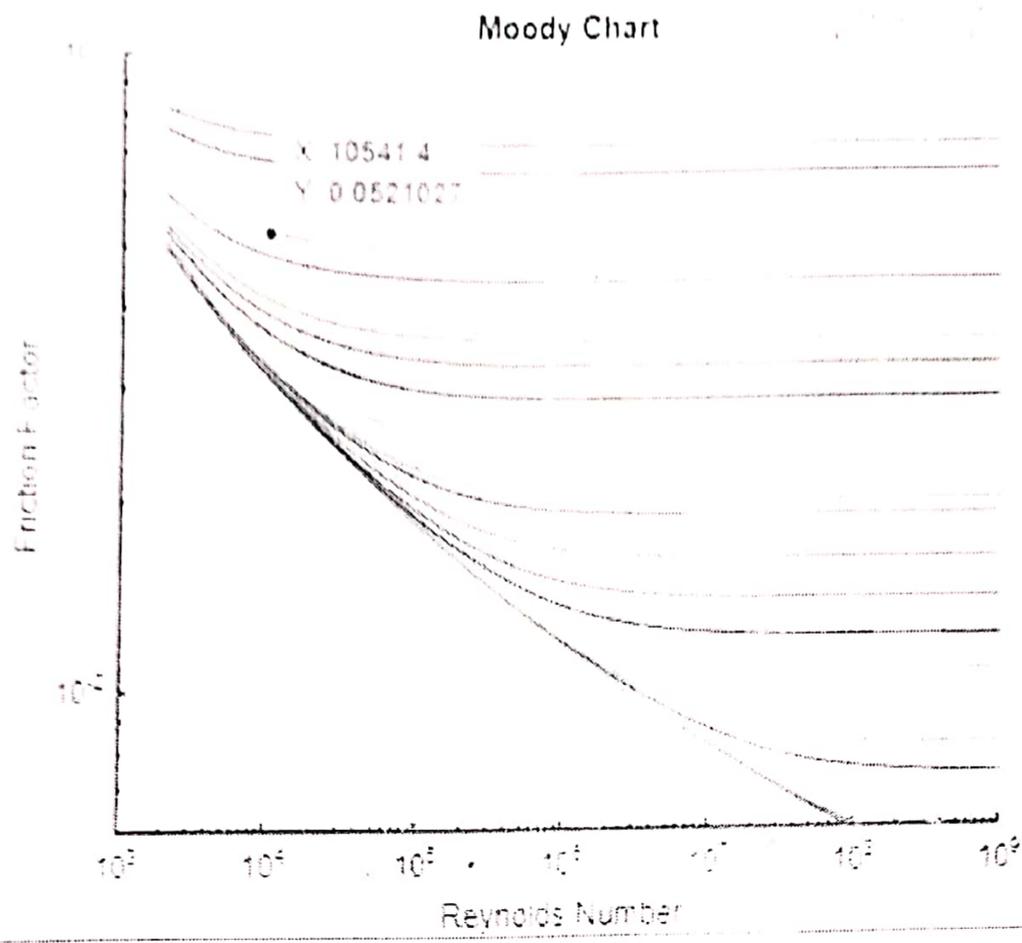
```

COMMAND WINDOW

Command Window

New to MATLAB? See resources for Getting Started.

1.0e-05 *													
Columns 1 through 14	0.0000	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
Columns 15 through 28	0.0004	0.0004	0.0005	0.0007	0.0008	0.0010	0.0012	0.0014	0.0017	0.0020	0.0024	0.0028	0.0034
Columns 29 through 42	0.0051	0.0063	0.0075	0.0091	0.0110	0.0133	0.0160	0.0193	0.0235	0.0281	0.0333	0.0400	0.0484
Columns 43 through 56	0.0700	0.0869	0.1048	0.1265	0.1526	0.1841	0.2213	0.2633	0.3207	0.3947	0.4715	0.5600	0.6600
Column 57	1.0000												



his is how can create Moody Chart in MATLAB.

3. Applications of Moody's chart

The Moody diagram can be applied to solve three types of problems, provided the fluid and the absolute roughness of the pipe are known:

- Calculation of the pressure drop or the pressure difference between two points, given the length of the pipe, the difference in height between the two points to be considered, the speed and the internal diameter of the pipe.
 - Determination of the flow, knowing the length and diameter of the pipe, plus the specific pressure drop.
 - Evaluation of the diameter of the pipe when the length, flow and pressure drop between the points to be considered are known.
- Problems of the first type are solved directly through the use of the diagram, while those of the second and third types require the use of a computer package. For example, in the third type, if the diameter of the pipe is not known, the Reynolds number cannot be evaluated directly, nor the relative roughness.

4. Conclusion

The moody diagram It consists of a series of curves drawn on logarithmic paper, which are used to calculate the friction factor present in the flow of a turbulent fluid through a circular duct.

With friction factor F the loss of energy due to friction is evaluated, an important value to determine the adequate performance of the pumps that distribute fluids such as water, gasoline, crude oil and others.

To know the energy in the flow of a fluid, it is necessary to know the gains and losses due to factors such as speed, height, the presence of devices (pumps and motors), the effects of the fluid's viscosity and the friction between it. and the walls of the pipe.

5. Bibliography

- Labeling in three axis , MathWorks .
- MATLAB
- Moody's Friction Factor - an overview | ScienceDirect Topics
- Moody chart - Wikipedia