# TUTORIAL of "Flows in Pipe Networks" (Rev. 5/12/2015)

Flows in Pipe Networks is a Matlab program developed by Arturo Leon at Oregon State University.

The developer makes no warranties, either express or implied, with respect to the program Flows in Pipe Networks described here, in its quality, performance, or fitness for any purpose.

To execute this program, first save the program to the address you prefer. For example: **C:\Pipes**. Then enter data of the pipe network in the input file **Pipe_Network_Data.xlsx** as follows:

1	[TITLE]	Model for Steady Flow Pipe Pipe Networks										
2		CE 313, Arturo Leon (Oregon State University)										
3	[OPTIONS]											
4	viscosity (m2/s)	0.000001										
5												
6												
7												
8												
9	[NODES]											
10	ID of	Node	Is there a	Is a flow	Is Node a free							
11	Nodes	Elev. (m)	reserv. at node?	given at node?	outflow?							
12	--------------	--------------	--------------	--------------	--------------							
13	A	80	NO	YES	NO							
14	B	80	NO	YES	NO							
15	C	75	NO	YES	NO							
16	D	100	NO	YES	NO							
17	E	80	NO	YES	NO							
18	F	80	NO	YES	NO							
19	G	150	NO	YES	NO							
20	H	210	YES	NO	NO							
21	I	10	YES	NO	NO							
22	[CONDUITS]											
23	ID of	Inlet	Outlet		Diameter	Pipe	Pipe	K (internal [EXIT LOSSES]			Is there a pump	Pump equation (head capacity curve hp = A + B*Q + C*Q^2), hp[m], Q[L/s]		
24	Conduits	Node	Node		(m)	Length (m)	roughness (mm)	losses	Inlet	Outlet	inside the conduit	A	B	C
25	--------------	--------------	--------------		--------------	----------	----------	----------	--------------	--------------	--------------	--------------	--------------	--------------
26	PIPE 1	A	B		0.3	1000.00	1.5	0	0	0	NO			
27	PIPE 2	B	C		0.3	1000.00	1.5	0	0	0	NO			
28	PIPE 3	A	D		0.25	1000.00	1.5	0	0	0	NO			
29	PIPE 4	B	E		0.3	1000.00	1.5	0	0	0	NO			
30	PIPE 5	C	F		0.25	1000.00	1.5	0	0	0	NO			
31	PIPE 6	D	E		0.25	1000.00	1.5	0	0	0	NO			
32	PIPE 7	E	F		0.25	1000.00	1.5	0	0	0	NO			
33	PIPE 8	D	G		0.3	1000.00	1.5	0	0	0	NO			
34	PIPE 9	G	F		0.25	1000.00	1.5	0	0	0	NO			
35	PIPE 10	G	H		0.4	1000.00	1.5	0	0	0	NO			
36	PIPE 11	I	B		0.4	10.00	1.5	0	0	0	YES	240	0	-0.00311
37														
38	[RESERVOIRS]													
39	ID of	Water Surface												
40	Nodes	Elev. (m)												
41	-----------------	--------------												
42	I	10												
43	H	210												
44														
45														
46	[FLOWS]	(Enter Flow demands at The external Nodes, if available) [Enter positive value if flow leaves the node, Negative value if flow enters to the node]												
47	ID of	Flow												
48	Nodes	(L/s)												
49	-----------------	--------------												
50	1	125.00000												
51	B	41.66667												
52	C	104.16667												
53	D	52.08333												
54	E	208.33333												
55	F	52.08333												
56	G	52.08333												
57														
58														
59														
60														
61														
62														
63	[ORDERPLOT]	Enter ID of Nodes from most upstream to most downstream]												
64	-----------------													
65	H													
66	G													
67	F													
68	E													
69	D													
70	1													
71	B													
72	I													

In the folder you downloaded the program, double click on **MAIN_SCRIPT.m** to open this Matlab file. Next, on the keyboard press F5 or click on **run** (▷). This will run the model and will show a window similar to what is shown below.
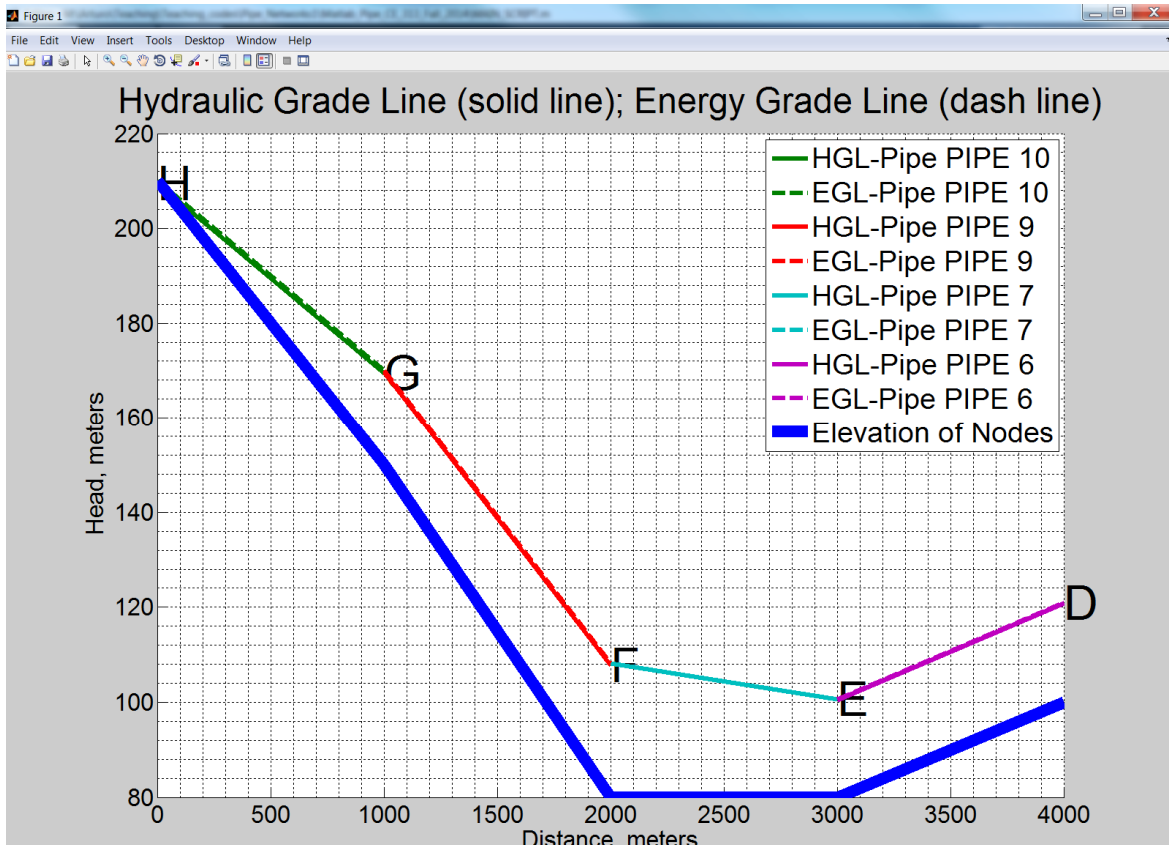
The plot above is a graph showing the energy and hydraulic grade lines for the **continuous** path chosen to plot in the input data ([**ORDERPLOT** in file **Pipe_Network_Data.xlsx**). Finally, a summary of the piezometric and total energy heads (left and right) and flow discharges for all pipes of the network is generated at the Matlab command window as follows:

```
&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&
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Hydraulic Grade Line (Pressure head + Elevation head)

pipe    Left head H_L    Right head H_R     Discharge        Velocity head
            [m]              [m]              [L/s]               [m]
PIPE 1     103.61677        105.80393       -45.53270          0.02115
PIPE 2     105.79083        102.26345        57.94420          0.03425
PIPE 3     103.50434        120.82650       -79.46730          0.13358
PIPE 4     105.77497        100.62813        70.08813          0.05011
PIPE 5     102.25250        108.14830       -46.22247          0.04519
PIPE 6     120.80358        100.52174        86.01718          0.15651
PIPE 7     100.62055        108.13580       -52.22803          0.05770
PIPE 8     120.47722        169.60507      -217.56781          0.48286
PIPE 9     169.60861        107.71417       150.53383          0.47932
PIPE 10    169.51808        209.43015      -420.18497          0.56985
PIPE 11      9.85048        105.67556       215.23170          0.14952


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&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&
Energy Grade Line (Pressure head + Elevation head + Velocity head)

pipe  Left total head  Right total head    Discharge        Velocity head
            [m]              [m]              [L/s]               [m]
PIPE 1     103.63792        105.82508       -45.53270          0.02115
PIPE 2     105.82508        102.29770        57.94420          0.03425
PIPE 3     103.63792        120.96008       -79.46730          0.13358
PIPE 4     105.82508        100.67824        70.08813          0.05011
PIPE 5     102.29770        108.19350       -46.22247          0.04519
PIPE 6     120.96008        100.67824        86.01718          0.15651
PIPE 7     100.67824        108.19350       -52.22803          0.05770
PIPE 8     120.96008        170.08794      -217.56781          0.48286
PIPE 9     170.08794        108.19350       150.53383          0.47932
PIPE 10    170.08794        210.00000      -420.18497          0.56985
PIPE 11     10.00000        105.82508       215.23170          0.14952


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Please send your suggestions for improvement or questions to:
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