

Assignment 4: 3D surface and contour plots using excel

General instruction:

1. All axis should be in black color with solid line of thickness 1.5.
2. Axis major tick mark should be outside with the interval of 2. There should not be any minor tick mark.
3. Axis title should be bold, times new roman font of size 12 and orientation should be corresponding to their axis.
4. The floor should intercept the z-axis at its minimum value.
5. All the data should be up to 2 decimal place.

Question 1.

The enthalpy of moist air (H) depends on dry bulb temperature (T) and specific humidity (W). The relationship between H , T and W are given by $H = 1.005 * \sin(T) + \cos(W)$. Let's assume T and W are integers and T varies randomly from [25 °C to 55 °C] and W varies from [10 to 30]. Create a data set for T (Having 15 temperature values) and W with an increment of 2. Accordingly, generate the value of H corresponding to each mesh point and draw a 3D surface plot. The minimum and maximum value of z-axis should be -2.25 and 2.25 respectively with a major increment of 1.25 unit. This will divide the data into 4 band. The legend for the value of (-2.25 to -1.125) should be dark red, (-1.125 to 0) in dark blue, (0 to 1.125) in dark green and (1.125 to 2.25) in yellow color respectively. Use the same color for floor and walls, which should differ from the legend color. Also plot the surface contour for the same data. Use “Fig. 1(a)” and “Fig. 1(b)” to represent the 3D surface plot and contour in the word file respectively.

Question 2.

Table 1 in excel file, attached in the assignment, shows the variation of maximum power generation through a nanopore with the grafting density and average flow velocity in mesh format. Draw a 3D surface plot showing the variation of maximum power generation as a function of grafting density as well as average flow velocity. The minimum and maximum value of z-axis should be -2 and 2 respectively with a major increment of 1 unit. This will divide the data into 4 band. The legend for the value of (-2 to -1) should be dark red, (-1 – 0) in dark blue, (0 – 1) in dark green and (1-2) in yellow color respectively. Use the same color for floor and walls which should be different from the legend color. Also plot the surface contour for the same data. Use “Fig. 2(a)” and “Fig. 2(b)” to represent the 3D surface plot and contour in the word file respectively.

Question 3.

The size of the droplet (L) generated through a micro-channel depend upon the flow rate (Q) as well as magnetic Bond number (Bo_m). The relationship between L , Q and Bo_m are given by

$L = 2Q^2 + 3 \sin(Bo_m)$. The Q varies from [0.3 to 3], and Bo_m varies from [0 to 30]. Create a data set for Q and Bo_m with an interval of 0.1 and 1, respectively. Accordingly, generate the value of L corresponding to each mesh point and draw a 3D surface plot. The minimum and maximum values of the z-axis should be -10 and 30, respectively, with a major increment of 10 units. This will divide the data into 4 band. The legend for the value of (-10 to 0) should be yellow color, (0 – 10) in dark green, (10 – 20) in dark blue and (20 - 30) in dark red respectively. Use the same color for floor and walls, which should differ from the legend color. Also plot the surface contour for the same data. Use “Fig. 3(a)” and “Fig. 3(b)” to represent the 3D surface plot and contour in the word file respectively.

Table 1. For Question 2. { This table is also attached as an Excel sheet in Assignment }

		Grafting density →																			
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
flow velocity ↓	1	1.43	1.80	1.95	1.86	1.55	1.10	0.60	0.20	-0.02	0.00	0.25	0.68	1.17	1.61	1.89	1.94	1.75	1.37	0.88	0.41
	1.5	1.38	1.74	1.90	1.81	1.50	1.04	0.55	0.14	-0.08	-0.06	0.19	0.62	1.12	1.56	1.84	1.89	1.70	1.31	0.83	0.36
	2	1.30	1.67	1.82	1.73	1.42	0.97	0.47	0.07	-0.15	-0.13	0.12	0.55	1.04	1.48	1.76	1.81	1.62	1.24	0.75	0.28
	2.5	1.21	1.57	1.73	1.64	1.33	0.87	0.38	-0.03	-0.25	-0.23	0.03	0.45	0.95	1.39	1.67	1.72	1.53	1.14	0.66	0.19
	3	1.10	1.46	1.62	1.53	1.22	0.76	0.27	-0.14	-0.36	-0.34	-0.08	0.34	0.84	1.28	1.56	1.61	1.42	1.03	0.55	0.08
	3.5	0.98	1.34	1.50	1.41	1.10	0.64	0.15	-0.26	-0.48	-0.46	-0.21	0.22	0.71	1.15	1.44	1.49	1.30	0.91	0.42	-0.05
	4	0.84	1.20	1.36	1.27	0.96	0.50	0.01	-0.39	-0.62	-0.60	-0.34	0.08	0.58	1.02	1.30	1.35	1.16	0.77	0.29	-0.18
	4.5	0.70	1.06	1.22	1.13	0.82	0.36	-0.13	-0.54	-0.76	-0.74	-0.49	-0.06	0.43	0.88	1.16	1.21	1.02	0.63	0.14	-0.33
	5	0.55	0.91	1.07	0.98	0.67	0.21	-0.28	-0.69	-0.91	-0.89	-0.63	-0.21	0.29	0.73	1.01	1.06	0.87	0.48	0.00	-0.47
	5.5	0.40	0.76	0.92	0.83	0.52	0.06	-0.43	-0.84	-1.06	-1.04	-0.78	-0.36	0.14	0.58	0.86	0.91	0.72	0.33	-0.15	-0.62
	6	0.25	0.61	0.77	0.68	0.37	-0.09	-0.58	-0.98	-1.20	-1.19	-0.93	-0.51	-0.01	0.43	0.71	0.76	0.57	0.18	-0.30	-0.77
	6.5	0.11	0.47	0.63	0.54	0.23	-0.23	-0.72	-1.13	-1.35	-1.33	-1.08	-0.65	-0.16	0.29	0.57	0.62	0.43	0.04	-0.45	-0.91
	7	-0.03	0.34	0.49	0.40	0.09	-0.36	-0.86	-1.26	-1.48	-1.46	-1.21	-0.78	-0.29	0.15	0.43	0.48	0.29	-0.09	-0.58	-1.05
	7.5	-0.15	0.21	0.37	0.28	-0.03	-0.49	-0.98	-1.38	-1.61	-1.59	-1.33	-0.91	-0.41	0.03	0.31	0.36	0.17	-0.22	-0.70	-1.17
	8	-0.26	0.10	0.26	0.17	-0.14	-0.60	-1.09	-1.49	-1.71	-1.70	-1.44	-1.02	-0.52	-0.08	0.20	0.25	0.06	-0.33	-0.81	-1.28
	8.5	-0.35	0.01	0.17	0.08	-0.23	-0.69	-1.18	-1.59	-1.81	-1.79	-1.54	-1.11	-0.61	-0.17	0.11	0.16	-0.03	-0.42	-0.91	-1.37
	9	-0.42	-0.06	0.09	0.01	-0.31	-0.76	-1.25	-1.66	-1.88	-1.86	-1.61	-1.18	-0.69	-0.25	0.03	0.09	-0.11	-0.49	-0.98	-1.45
	9.5	-0.48	-0.12	0.04	-0.05	-0.36	-0.82	-1.31	-1.71	-1.94	-1.92	-1.66	-1.24	-0.74	-0.30	-0.02	0.03	-0.16	-0.55	-1.03	-1.50
	10	-0.51	-0.15	0.01	-0.08	-0.39	-0.85	-1.34	-1.75	-1.97	-1.95	-1.70	-1.27	-0.77	-0.33	-0.05	0.00	-0.19	-0.58	-1.07	-1.53