

2-D LID-DRIVEN SQUARE CAVITY FLOW BENCHMARK

Re = 30000

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Table 1. Cavity vortex map

	ψ	ω	x	y
PV	-0.1219599	-1.899328	0.5083872	0.5253750
TL1	0.004391214	2.645013	0.08451780	0.9126482
TL2	-0.0001798777	-1.358398	0.03101432	0.8120313
BR1	0.002488855	8.436748	0.6882220	0.03428865
BR2	-0.0006695250	-0.659359	0.9322376	0.1215085
BR3	4.36203E-07	0.0197606	0.9862466	0.01596500
BR4	-1.1802E-11	-0.0001468	0.9991131	0.00088716
BL1	0.001517226	3.927237	0.04022362	0.2021600
BL2	-1.84196E-04	-0.371778	0.07423471	0.05969149
BL3	6.68040E-09	0.0032988	0.00448170	0.00443509
BL4	-1.7210E-13	-1.824E-05	0.00024627	0.00024637

Table 2. Vertical velocity across various horizontal planes

x	y = 0.05	y = 0.1	y = 0.5	y = 0.9	y = 0.99
1.0000	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000
0.9950	-0.0002362	-0.0030209	-0.1148373	-0.6456198	-0.4331362
0.9900	-0.0006588	-0.0060800	-0.3446346	-0.5679858	-0.2218985
0.9800	-0.0018551	-0.0111881	-0.5810917	-0.2942307	-0.0684774
0.9700	-0.0031566	-0.0134678	-0.5060961	-0.2286003	-0.0247639
0.9688	-0.0032997	-0.0135202	-0.4990797	-0.2259646	-0.0221351
0.9609	-0.0040914	-0.0128300	-0.4775317	-0.2180881	-0.0112183
0.9531	-0.0045337	-0.0108294	-0.4716224	-0.2156635	-0.0064826
0.9453	-0.0045870	-0.0081513	-0.4645933	-0.2124461	-0.0043730
0.9063	-0.0012611	0.0034839	-0.4184727	-0.1771614	-0.0033538
0.8594	0.0003049	0.0124562	-0.3638908	-0.1371587	-0.0038466
0.8047	0.0020243	0.0334182	-0.3024403	-0.1027194	-0.0033399
0.6800	-0.0585046	-0.2160312	-0.1710860	-0.0461401	-0.0007289
0.5000	-0.0248336	-0.0283716	0.0053175	0.0253909	0.0056138
0.3500	0.1158730	0.1168462	0.1501003	0.1317398	0.0219802
0.2344	0.0189678	0.2350860	0.2641092	0.2884727	-0.0008734
0.2266	0.0111140	0.2396290	0.2719417	0.2935005	-0.0005603
0.1563	-0.0079828	0.0284284	0.3439256	0.0721361	0.0087539
0.0938	-0.0028941	-0.0182931	0.4116979	0.0130651	0.0129288
0.0781	0.0002596	-0.0102947	0.4296618	-0.0068207	0.0146428
0.0703	0.0014401	-0.0062987	0.4387089	-0.0170943	0.0156418
0.0625	0.0023182	-0.0029403	0.4481467	-0.0276546	0.0167460
0.0400	0.0032579	0.0026808	0.4807454	-0.0600295	0.0205921
0.0300	0.0030624	0.0035246	0.4769918	-0.0774888	0.0228021
0.0200	0.0025354	0.0034273	0.4262609	-0.0996095	0.0259676
0.0100	0.0015836	0.0022910	0.3122774	-0.0865803	0.0316121
0.0000	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000

Table 3. Vorticity across various horizontal planes including the lid (Y=1)

x	y = 0.05	y = 0.1	y = 0.5	y = 0.9	y = 0.95	y = 1
1.0000	0.02536	0.58548	5.60190	184.2051	288.7116	-
0.9900	0.10905	0.61310	47.11213	-43.07786	-32.81385	-441.0919
0.9800	0.16799	0.41726	-2.13348	-13.07645	-43.27584	-216.2536
0.9700	0.19438	0.06271	-7.20067	-2.44849	-14.55303	-144.6387
0.9688	0.19510	0.01845	-6.11245	-1.95645	-5.65336	-140.1892
0.9609	0.18700	-0.24377	-1.77682	-0.49968	-5.09666	-121.5041
0.9531	0.15996	-0.42592	-1.43373	-0.49014	-2.67522	-113.2577
0.9453	0.12038	-0.52805	-1.75357	-0.86858	-1.46208	-109.4894
0.9063	-0.04676	-0.46687	-1.89855	-1.91393	-0.80476	-105.9351
0.8594	-0.05730	-1.30389	-1.89933	-1.91220	-0.54036	-102.1754
0.8047	-1.03842	3.68987	-1.89933	-1.89737	-1.39968	-95.06942
0.6800	10.49144	-3.08203	-1.89933	-1.89944	-1.95677	-80.77218
0.5000	-2.48949	-1.90144	-1.89933	-1.89940	-1.95692	-82.10714
0.3500	-1.82608	-1.89119	-1.89933	-1.89768	-1.92107	-136.6736
0.2344	6.39432	-1.43676	-1.89933	-0.86297	11.63114	-196.8919
0.2266	4.22018	0.38972	-1.89933	0.36668	10.40221	-195.1355
0.1563	-0.00164	5.35009	-1.89933	2.22703	2.12431	-214.2552
0.0938	-0.48933	-0.66488	-1.89983	2.64201	2.58025	-265.4926
0.0781	-0.36500	-0.80224	-1.88402	2.64516	2.57846	-288.5472
0.0703	-0.29575	-0.68792	-1.88337	2.64459	2.57037	-303.1562
0.0625	-0.22628	-0.53701	-1.95403	2.63973	2.56095	-320.7395
0.0400	-0.05598	-0.16635	-1.62997	2.66644	2.65700	-400.9614
0.0300	-0.00005	-0.04801	1.79006	3.08524	3.00126	-465.9193
0.0200	0.05328	0.06112	7.47215	2.84610	3.86737	-579.1358
0.0100	0.11687	0.17258	17.76417	-6.23139	3.67829	-849.1702
0.0000	0.19904	0.28761	38.13601	-7.03790	-32.73478	-

Table 4. Horizontal velocity across various vertical planes

y	x = 0.05	x = 0.1	x = 0.5	x = 0.9	x = 0.95
1.0000	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000
0.9900	-0.1526295	-0.1592415	0.5040243	0.4166034	0.3839220
0.9800	-0.1407232	-0.1744778	0.5211410	0.2561025	0.1878009
0.9766	-0.1233479	-0.1521884	0.5244189	0.2369484	0.1558691
0.9688	-0.0908293	-0.1126577	0.5203636	0.2190041	0.1125304
0.9609	-0.0695987	-0.0907426	0.5082342	0.2150690	0.0916888
0.9531	-0.0544871	-0.0742784	0.4946340	0.2130120	0.0821380
0.8516	0.0707378	0.0701811	0.3470584	0.1247948	0.0560731
0.7344	0.0348794	0.2157665	0.2095198	0.0583028	0.0240076
0.6172	0.1071580	0.1092041	0.0891552	0.0037113	-0.0054496
0.5000	0.0179489	0.0131606	-0.0229511	-0.0661058	-0.0608436
0.4531	-0.0122883	-0.0237538	-0.0666685	-0.1023377	-0.0971608
0.2813	-0.1489010	-0.1910801	-0.2245730	-0.2791180	-0.0003400
0.1719	0.0317518	-0.0935748	-0.3234545	0.0306481	0.0100472
0.1016	0.0017293	0.0166702	-0.3853543	-0.0001413	-0.0068318
0.0703	-0.0003516	0.0079001	-0.4121978	-0.0074454	-0.0076980
0.0625	-0.0010243	0.0055812	-0.4183563	-0.0082154	-0.0068946
0.0547	-0.0017520	0.0032921	-0.4253201	-0.0084867	-0.0059081
0.0400	-0.0029467	-0.0009924	-0.4512031	-0.0078351	-0.0039861
0.0300	-0.0032650	-0.0035655	-0.4632948	-0.0067441	-0.0028316
0.0200	-0.0028927	-0.0050355	-0.4084634	-0.0052007	-0.0018256
0.0100	-0.0017523	-0.0042317	-0.2716350	-0.0030516	-0.0008990
0.0000	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000

Table 5. Vorticity across various vertical planes including the right wall (X=1)

y	x = 0.05	x = 0.1	x = 0.5	x = 0.9	x = 0.95	x = 1
1.0000	-358.0155	-258.1086	-82.10714	-105.6369	-111.4032	-
0.9900	-8.77198	-20.12622	-4.99026	-29.09519	-32.43166	982.1534
0.9800	5.28063	6.44552	1.45027	-7.21629	-11.64970	645.5414
0.9766	5.23203	6.43861	0.26890	-4.18548	-8.54350	570.1720
0.9688	3.80667	3.81370	-1.39159	-0.95518	-4.48604	443.5434
0.9609	2.86165	2.49854	-1.93978	-0.26405	-2.48826	360.1904
0.9531	2.58755	2.50656	-1.97919	-0.49571	-1.42959	305.3375
0.8516	0.41265	1.44116	-1.89933	-1.90893	-1.33482	162.3070
0.7344	10.59819	-1.31463	-1.89933	-1.89879	-1.83529	130.4070
0.6172	-0.11154	-1.89091	-1.89933	-1.89927	-1.85540	85.63835
0.5000	-2.25320	-1.90022	-1.89933	-1.89879	-1.56878	5.60190
0.4531	-2.27139	-1.90032	-1.89933	-1.89899	-1.53010	-7.29972
0.2813	9.26899	-2.00696	-1.89933	-3.96321	1.30744	-1.54196
0.1719	2.70660	11.09919	-1.89933	-0.14701	-0.94956	2.41450
0.1016	-0.32711	-0.32632	-1.90099	-0.45340	-0.49953	0.62055
0.0703	-0.18031	-0.63810	-1.83104	-0.24952	0.00804	0.14702
0.0625	-0.16474	-0.59362	-1.81556	-0.17420	0.08700	0.08784
0.0547	-0.14239	-0.55111	-2.07675	-0.09800	0.13233	0.04487
0.0400	-0.06845	-0.46308	-3.32473	0.02429	0.14690	-0.00337
0.0300	0.00567	-0.34577	0.09723	0.09030	0.12939	-0.01767
0.0200	0.08609	-0.12513	9.47714	0.15913	0.10940	-0.01901
0.0100	0.15357	0.21337	15.57370	0.24810	0.09610	-0.00876
0.0000	0.19638	0.62537	51.03594	0.36122	0.08689	-

Table 6. Extrema of the velocity through the centerlines of the cavity

u_{\min}	y_{\min}	v_{\max}	x_{\max}	v_{\min}	x_{\min}
-0.4641557	0.0316567	0.4831410	0.0357229	-0.5813419	0.9803715

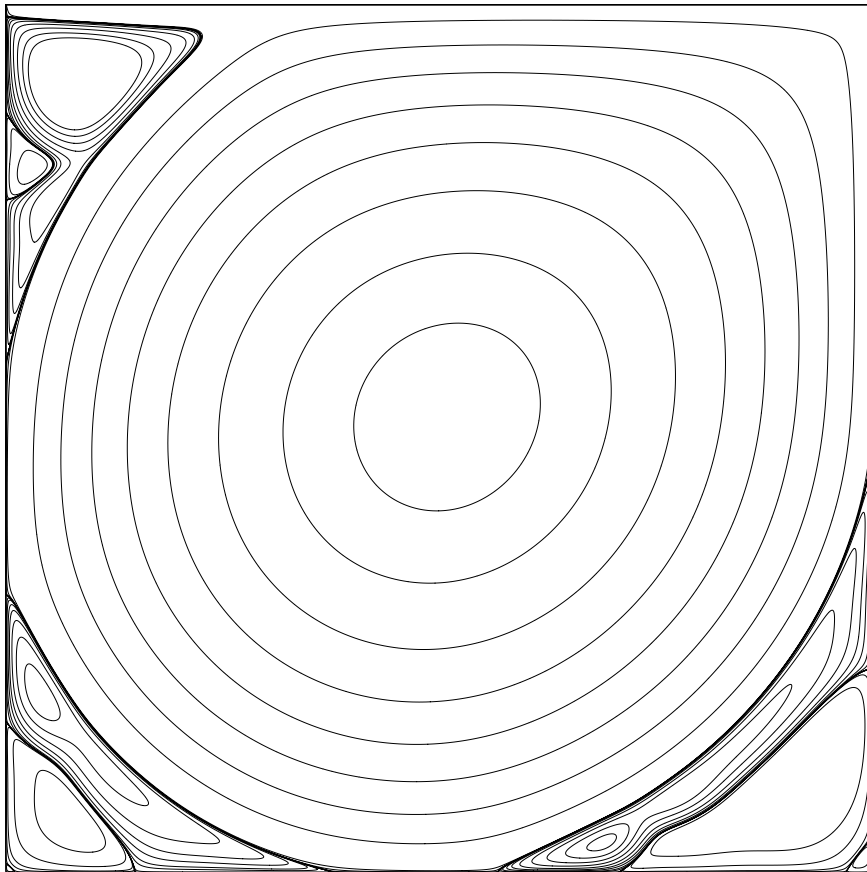


Figure 1. Streamlines, manual levels.

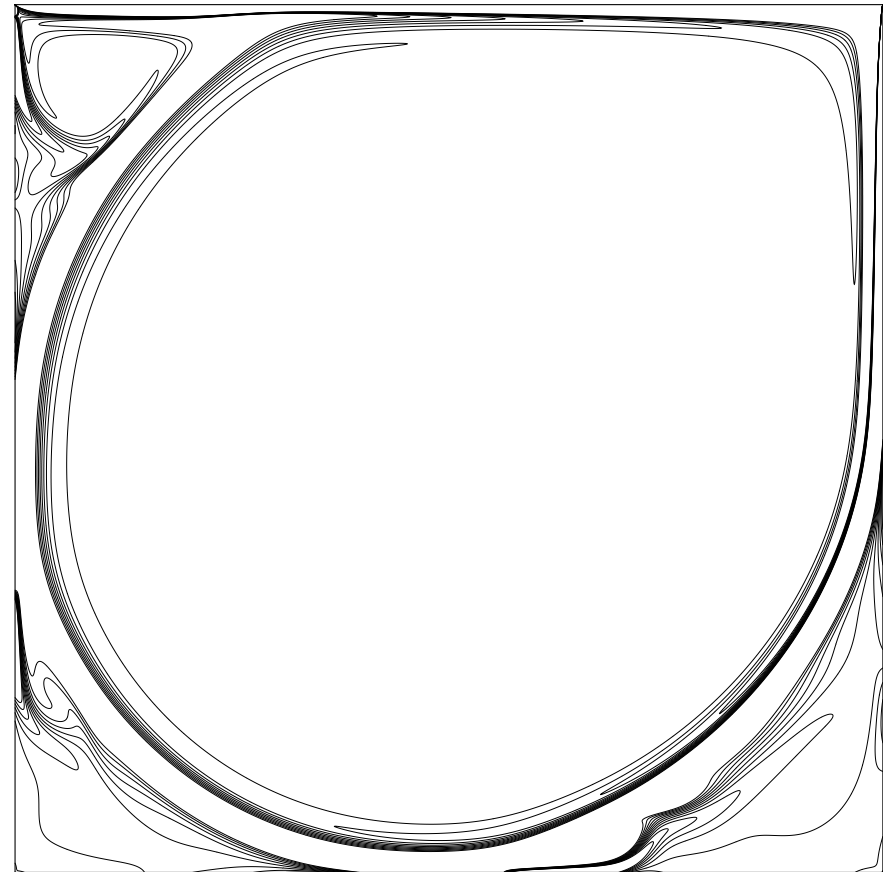


Figure 2. Vorticity contours, levels from -5 to 5 with step 1.