2-D LID-DRIVEN SQUARE CAVITY FLOW BENCHMARK Re = 20000

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Table 1. Cavity vortex map

	ψ	ϖ	x	y
PV	-0.1221933	-1.905322	0.5095348	0.5267410
TL1	0.003760115	2.519055	0.08033160	0.9116596
TL2	-7.29116E-05	-0.973563	0.02461020	0.8193110
BR1	0.002808091	6.205517	0.7227326	0.04314815
BR2	-0.0004644788	-0.566538	0.9304309	0.1050798
BR3	2.77122E-08	0.00568829	0.9931738	0.00700636
BR4	-6.8789E-13	-4.251E-05	0.9995841	0.00041568
BL1	0.001639927	2.974038	0.04795869	0.1830761
BL2	-8.55758E-05	-0.254140	0.05940137	0.05449665
BL3	2.43659E-09	0.0019895	0.00347015	0.00346378

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	-0.0006722	-0.0031678	-0.1033744	-0.5977146	-0.4433179
0.9900	-0.0013776	-0.0058449	-0.2897749	-0.6419847	-0.2393192
0.9800	-0.0027225	-0.0093987	-0.5683794	-0.3531802	-0.0852211
0.9700	-0.0037326	-0.0103527	-0.5454250	-0.2450674	-0.0347908
0.9688	-0.0038205	-0.0103065	-0.5360061	-0.2387830	-0.0314666
0.9609	-0.0041951	-0.0093169	-0.4897878	-0.2145771	-0.0168633
0.9531	-0.0042140	-0.0074919	-0.4730645	-0.2055667	-0.0097795
0.9453	-0.0039227	-0.0052402	-0.4661113	-0.2011395	-0.0061944
0.9063	-0.0007289	0.0051323	-0.4217496	-0.1744631	-0.0028607
0.8594	0.0005179	0.0211735	-0.3661212	-0.1360510	-0.0031836
0.8047	0.0102113	0.0154493	-0.3038122	-0.1016813	-0.0028739
0.6800	-0.0771462	-0.2213500	-0.1711273	-0.0455901	-0.0006041
0.5000	-0.0182749	-0.0224263	0.0064618	0.0251130	0.0052544
0.3500	0.1152924	0.1203038	0.1520420	0.1268847	0.0182212
0.2344	0.0184660	0.2284688	0.2668454	0.2819400	0.0018775
0.2266	0.0119320	0.2249366	0.2747423	0.2867754	0.0007240
0.1563	-0.0061822	0.0278957	0.3473857	0.0783932	0.0088971
0.0938	-0.0043866	-0.0115905	0.4157631	0.0171622	0.0152536
0.0781	-0.0020647	-0.0111618	0.4339107	-0.0017859	0.0176789
0.0703	-0.0010038	-0.0105106	0.4438184	-0.0115574	0.0191379
0.0625	-0.0000631	-0.0094348	0.4549452	-0.0216060	0.0208074
0.0400	0.0017462	-0.0039399	0.4765349	-0.0538216	0.0273845
0.0300	0.0020315	-0.0011571	0.4525582	-0.0726734	0.0318398
0.0200	0.0019157	0.0009017	0.3912552	-0.0900242	0.0384955
0.0100	0.0012903	0.0015092	0.2754917	-0.0686169	0.0496771
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	0.12838	0.67758	9.04061	154.4742	256.1678	-
0.9900	0.14847	0.48169	40.07670	-30.47572	4.56176	-394.9978
0.9800	0.14522	0.21461	9.29382	-18.02941	-43.74377	-208.4423
0.9700	0.11759	-0.06765	-8.71886	-5.64085	-17.91398	-137.2517
0.9688	0.11289	-0.09868	-8.56422	-4.85997	-8.40550	-132.2923
0.9609	0.07671	-0.27518	-4.35843	-1.81712	-7.74710	-110.0032
0.9531	0.03613	-0.39615	-1.81699	-0.83467	-4.75306	-98.80475
0.9453	-0.00393	-0.46831	-1.48478	-0.67779	-3.14088	-92.94417
0.9063	-0.10899	-0.61704	-1.91265	-1.69145	-2.17012	-85.95572
0.8594	-0.22131	-1.36871	-1.90534	-1.94109	-0.60060	-82.82093
0.8047	-1.61158	3.93569	-1.90532	-1.91378	-0.88994	-77.29753
0.6800	10.84490	-3.62395	-1.90532	-1.90404	-1.88387	-65.60582
0.5000	-3.08387	-1.90133	-1.90532	-1.90498	-1.96576	-66.07536
0.3500	1.63768	-1.85230	-1.90532	-1.90113	-1.46658	-107.9964
0.2344	5.29406	1.88815	-1.90532	-0.38582	9.33041	-167.6144
0.2266	3.77817	3.94216	-1.90532	0.65506	9.63018	-167.0262
0.1563	0.05776	4.65578	-1.90529	4.72447	2.86309	-175.7498
0.0938	-0.39235	-0.16972	-1.89067	2.53792	2.35047	-218.6361
0.0781	-0.33473	-0.49504	-1.93482	2.50911	2.41788	-237.8875
0.0703	-0.29213	-0.61763	-2.04829	2.50240	2.45689	-250.0645
0.0625	-0.24466	-0.69531	-2.18764	2.49712	2.50803	-264.7214
0.0400	-0.10290	-0.59284	0.14450	2.75342	2.87939	-331.7697
0.0300	-0.04221	-0.41754	3.75340	3.06828	3.31107	-386.2544
0.0200	0.01994	-0.20615	7.57641	1.36114	3.95028	-481.5315
0.0100	0.08878	0.02419	18.04531	-5.49638	2.17407	-711.0205
0.0000	0.16835	0.27493	33.14318	-6.41051	-24.32426	-

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	-0.1274775	-0.1076787	0.5243411	0.4778119	0.4456290
0.9800	-0.1479393	-0.1850800	0.5085197	0.2891271	0.2307785
0.9766	-0.1338978	-0.1689536	0.5142423	0.2591122	0.1908356
0.9688	-0.0997813	-0.1244189	0.5170956	0.2218650	0.1319222
0.9609	-0.0733174	-0.0917083	0.5096340	0.2070662	0.0995807
0.9531	-0.0550130	-0.0715706	0.4975798	0.2009734	0.0820324
0.8516	0.0545477	0.0548758	0.3478160	0.1224036	0.0502361
0.7344	0.0431004	0.2076334	0.2089737	0.0564420	0.0216433
0.6172	0.0987045	0.1053250	0.0880775	0.0025582	-0.0070393
0.5000	0.0162520	0.0107917	-0.0241863	-0.0656088	-0.0595995
0.4531	-0.0143152	-0.0259847	-0.0679313	-0.1010553	-0.0955228
0.2813	-0.1289917	-0.1959557	-0.2260104	-0.2767985	-0.0022126
0.1719	0.0088258	-0.0820483	-0.3253634	0.0206590	0.0127239
0.1016	0.0096480	0.0167361	-0.3885131	0.0062003	-0.0031133
0.0703	0.0013522	0.0100963	-0.4156922	-0.0041070	-0.0054099
0.0625	0.0003597	0.0078257	-0.4242428	-0.0054547	-0.0053045
0.0547	-0.0004737	0.0056441	-0.4366904	-0.0063635	-0.0050192
0.0400	-0.0016581	0.0019762	-0.4633802	-0.0069461	-0.0041798
0.0300	-0.0020694	0.0000172	-0.4472206	-0.0065047	-0.0034662
0.0200	-0.0020073	-0.0012173	-0.3693825	-0.0053088	-0.0026103
0.0100	-0.0013452	-0.0013747	-0.2452651	-0.0032049	-0.0015014
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	-295.8360	-212.4476	-66.07536	-85.60644	-96.02283	-
0.9900	-14.13888	-29.06646	-14.42334	-30.13030	-32.92575	797.3678
0.9800	3.67809	3.47286	1.93488	-10.58208	-14.47031	547.3775
0.9766	4.64584	5.56891	1.14407	-7.22853	-11.28183	490.6492
0.9688	4.37670	5.20779	-0.59253	-2.87839	-6.80593	390.5653
0.9609	3.38876	3.35211	-1.55821	-1.11675	-4.43098	320.2030
0.9531	2.78083	2.42801	-1.92014	-0.60429	-3.08133	271.4100
0.8516	-0.23311	0.44193	-1.90532	-1.93817	-0.89210	133.0523
0.7344	10.34987	-0.25277	-1.90532	-1.90573	-1.47533	106.4809
0.6172	1.59553	-1.90901	-1.90532	-1.90453	-1.54446	70.28488
0.5000	-1.78875	-1.89712	-1.90532	-1.90782	-1.53412	9.04061
0.4531	-1.87895	-1.89644	-1.90532	-1.91545	-3.13958	-4.60977
0.2813	8.82282	-2.35569	-1.90532	-0.00435	2.09581	-1.64730
0.1719	2.93031	8.37645	-1.90533	0.82745	-0.76225	1.07214
0.1016	-0.72611	0.02882	-1.90372	-0.71489	-0.44768	0.70288
0.0703	-0.29079	-0.44676	-1.92113	-0.29124	-0.11014	0.28982
0.0625	-0.23595	-0.44517	-2.27758	-0.21873	-0.04819	0.21857
0.0547	-0.19077	-0.42178	-2.86398	-0.15168	-0.00133	0.15913
0.0400	-0.10924	-0.33664	-1.69082	-0.03149	0.05106	0.07386
0.0300	-0.04649	-0.24583	3.69438	0.05312	0.07197	0.03241
0.0200	0.02351	-0.12194	10.03934	0.14817	0.09461	0.00460
0.0100	0.09702	0.03749	14.09989	0.25826	0.12807	-0.00533
0.0000	0.17055	0.23315	39.65880	0.38187	0.17348	-

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

u_{min}	y_{min}	v_{max}	x_{max}	v_{min}	x_{min}
-0.4641310	0.0380381	0.4775601	0.0428912	-0.5828170	0.9768788

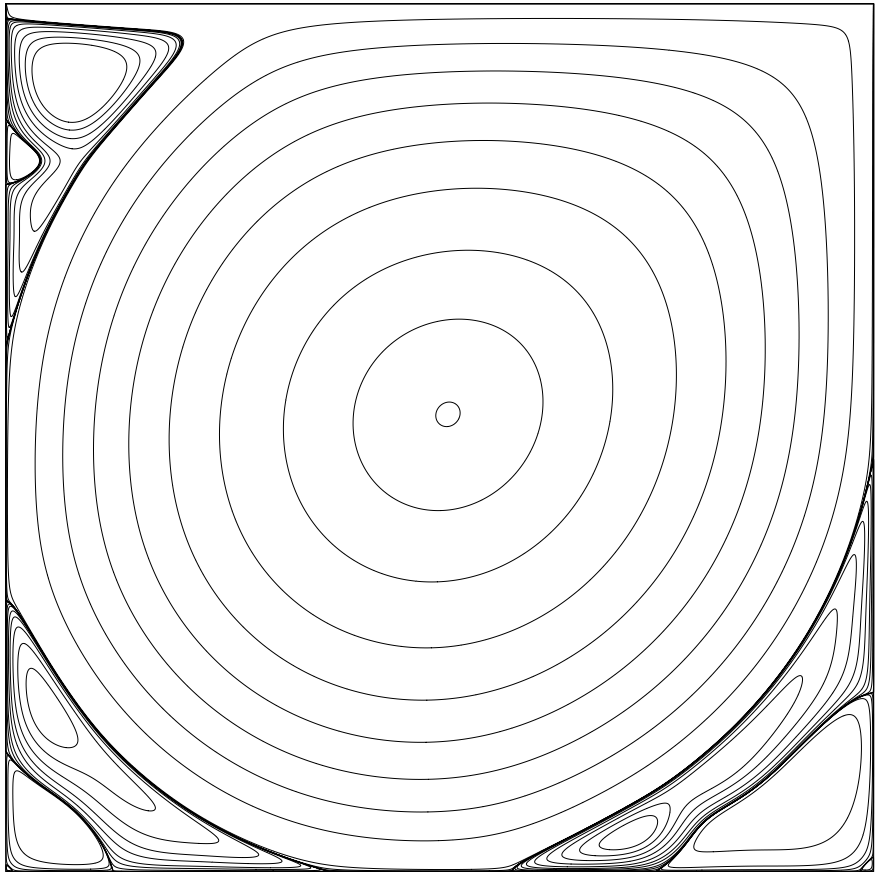

Figure 1. Streamlines, manual levels.

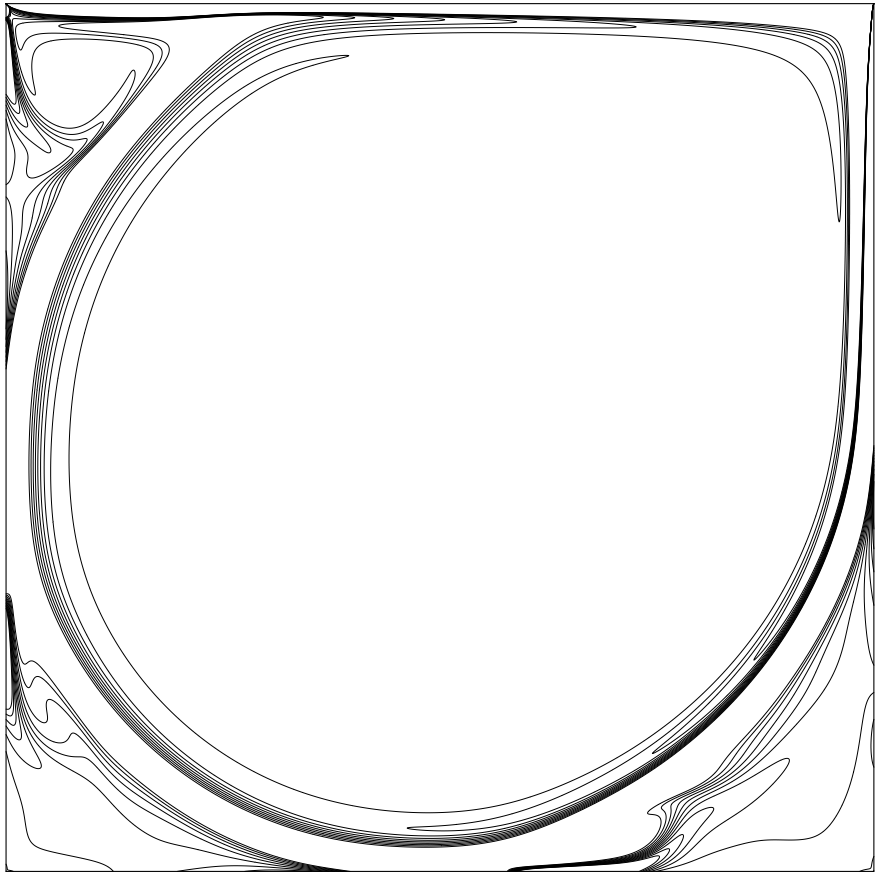

Figure 2. Vorticity contours, levels from -5 to 5 with step 1.