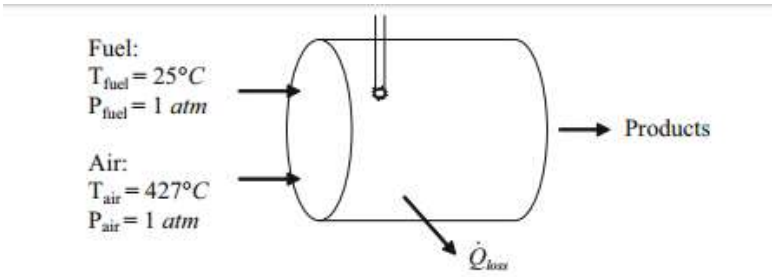
Name: **Enrolment No:**	UPES UNIVERSITY WITH A PURPOSE

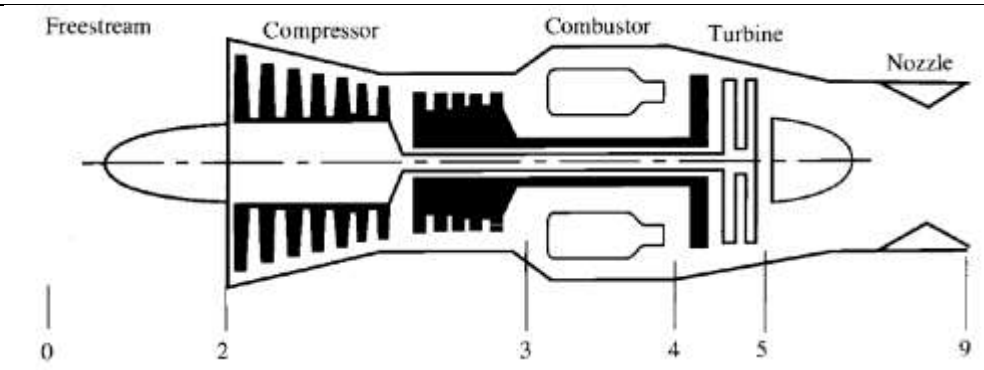
UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
End Semester Examination, December 2021

Course: Gas Dynamics and Jet Propulsion **Semester: VII**
Program: B.Tech ASE, ASE+AVE **Time 03 hrs.**
Course Code: ASEG 4014 **Max. Marks: 100**
Number of pages: 11
Instructions: Isentropic, Shock tables, Fanno tables, Ryleigh tables are included

SECTION A

S. No.		Marks	CO
Q 1	What are oblique shock intakes? Does the stagnation pressure loss for such inlet greater than an inlet with a single normal shock.	**4**	**CO2**
Q 2	Explain about subsonic inlets, Inlet drag and inlet distortion and explain about its effect on inlet design and performance in aircraft engines?	**4**	**CO1**
Q 3	Demonstrate the assumptions of ideal Cycle Parametric Cycle Analysis for various Engines, also comment on the Real cycle Analysis consideration on component efficiencies.	**4**	**CO2**
Q 4	Explain the process of combustion in gas turbine combustion chamber, Illiterate using a Jet engine Burner and bring out the various zones that play major role in the process of combustion?	**4**	**CO1**
Q 5	Explain the performance improvements of adding afterburner in turbojet when compared with ideal turbojet without afterburner.	**4**	**CO1**
	SECTION B		
Q 6	Air at inlet to an insulated constant area duct of diameter 160 mm has a Mach number of 0.36. The mean friction factor of the duct for the flow conditions is 0.0025. What length of the pipe would give a 10% loss in stagnation pressure? What is the Mach number at the corresponding exit section? What is percentage loss in stagnation pressure, if the flow extends to sonic condition?	**10**	**CO3**
Q 7	A gaseous Mixture of air and fuel enters a ramjet combustion chamber with velocity 60 m/s, temperature 50 ^{o}C and pressure 35 kPa. The heat of reaction of the mixture for the particular fuel air ration employed is 1160 kJ/kg. Find the condition of stream at the exit of combustion chamber, if friction is neglected and the cross sectional area is assumed constant. Assume the properties of both reactants and products of combustion are the same as air.	**10**	**CO2**

Q 8	Explain about Nacelle and Interference Drag and types of flow configurations in the diffusers. Explain about the challenges in Supersonic intakes design for fighter aircrafts.	**10**	**CO4**
Q 9	Consider the combustion chamber in a jet engine at cruising altitude. For simplicity, the combustor is operated at 1 atm of pressure and burns a stoichiometric (ϕ=0.92) mixture of n-heptane (C7H16) and air. The intake conditions are as indicated below  (a). Write the stoichiometric chemical reaction for the fuel with air. (b) If the mass flow rate of fuel is 1 kg/s, what is the mass flow rate of air?	**10**	**CO2**
	(OR) A convergent- divergent nozzle operating with inlet conditions of 4 bar and 450^0 C with negligible inlet velocity, is expected to give an exit static pressure of 1 bar under ideal conditions. Estimate the exit temperature and Mach number assuming nozzle efficiency of 0.92. The expansion takes place to the same exit pressure as in the ideal case. Take air as the working fluid?		
SECTION-C			
Q 10	(a). An aircraft engine employs a subsonic inlet diffuser of area ratio 4. Free stream air at a total pressure and temperature of 1×10^5 N/m^2 and 570 K approaches the diffuser with a Mach number 2.2. A shock wave stands just outside the diffuser inlet. Determine the Mach number, pressure and temperature of the air at the exit of the diffuser. Also fine the loss in stagnation pressure of air. (b)Explain how does a shock wave develop in the diverging section of a supersonic nozzle. When does this wave move towards the exit?	**15+5**	**CO4**
Q 11	Derive the expressions for performance in Turbojet using parametric cycle analysis by considering ideal process.	**20**	**CO5**



(OR)

Consider a turbo jet after burner engine with losses, Derive the expressions for performance of a turbofan engines, Specific Thrust, Specific Fuel Consumption, Exit Velocity Ratio, Thermal Efficiency, Propulsive Efficiency using real cycle analysis

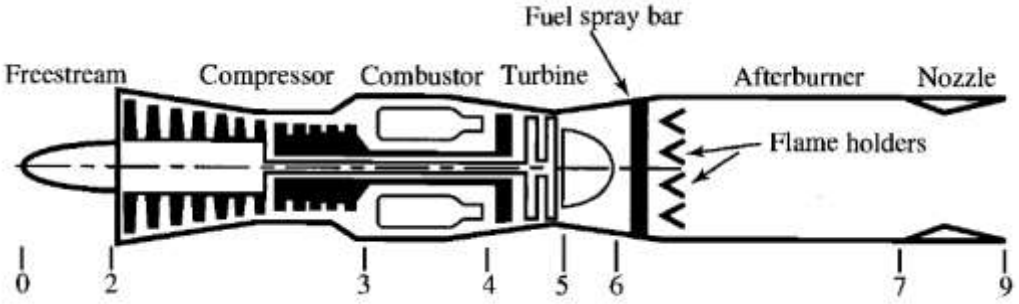


Table A.1: Isentropic flow properties for $\gamma = 1.4$

M	T/T_0	P/P_0	A/A^*	PA/P_0A^*	μ	ν
0.02	0.9999	0.9997	28.9421	28.9340	-	-
0.04	0.9997	0.9989	14.4815	14.4653	-	-
0.06	0.9993	0.9975	9.6659	9.6416	-	-
0.08	0.9987	0.9955	7.2616	7.2292	-	-
0.10	0.9980	0.9930	5.8218	5.7813	-	-
-	-	-	-	-	-	-
0.12	0.9971	0.9900	4.8643	4.8156	-	-
0.14	0.9961	0.9864	4.1824	4.1255	-	-
0.16	0.9949	0.9823	3.6727	3.6077	-	-
0.18	0.9936	0.9776	3.2779	3.2047	-	-
0.20	0.9921	0.9725	2.9635	2.8820	-	-
-	-	-	-	-	-	-
0.22	0.9904	0.9668	2.7076	2.6178	-	-
0.24	0.9886	0.9607	2.4956	2.3975	-	-
0.26	0.9867	0.9541	2.3173	2.2109	-	-
0.28	0.9846	0.9470	2.1656	2.0508	-	-
0.30	0.9823	0.9395	2.0351	1.9119	-	-
-	-	-	-	-	-	-
0.32	0.9799	0.9315	1.9219	1.7902	-	-
0.34	0.9774	0.9231	1.8229	1.6827	-	-
0.36	0.9747	0.9143	1.7358	1.5871	-	-
0.38	0.9719	0.9052	1.6587	1.5014	-	-
0.40	0.9690	0.8956	1.5901	1.4242	-	-
-	-	-	-	-	-	-
0.42	0.9659	0.8857	1.5289	1.3542	-	-
0.44	0.9627	0.8755	1.4740	1.2905	-	-
0.46	0.9594	0.8650	1.4246	1.2322	-	-
0.48	0.9559	0.8541	1.3801	1.1788	-	-
0.50	0.9524	0.8430	1.3398	1.1295	-	-
-	-	-	-	-	-	-
0.52	0.9487	0.8317	1.3034	1.0840	-	-
0.54	0.9449	0.8201	1.2703	1.0417	-	-
0.56	0.9410	0.8082	1.2403	1.0024	-	-
0.58	0.9370	0.7962	1.2130	0.9658	-	-
0.60	0.9328	0.7840	1.1882	0.9316	-	-
-	-	-	-	-	-	-
0.62	0.9286	0.7716	1.1656	0.8995	-	-
0.64	0.9243	0.7591	1.1451	0.8693	-	-
0.66	0.9199	0.7465	1.1265	0.8410	-	-
0.68	0.9153	0.7338	1.1097	0.8142	-	-
0.70	0.9107	0.7209	1.0944	0.7890	-	-
-	-	-	-	-	-	-
0.72	0.9061	0.7080	1.0806	0.7651	-	-
0.74	0.9013	0.6951	1.0681	0.7424	-	-
0.76	0.8964	0.6821	1.0570	0.7209	-	-
0.78	0.8915	0.6691	1.0471	0.7005	-	-
0.80	0.8865	0.6560	1.0382	0.6811	-	-
0.82	0.8815	0.6430	1.0305	0.6626	-	-
0.84	0.8763	0.6300	1.0237	0.6449	-	-
0.86	0.8711	0.6170	1.0179	0.6281	-	-
0.88	0.8659	0.6041	1.0129	0.6119	-	-
0.90	0.8606	0.5913	1.0089	0.5965	-	-
-	-	-	-	-	-	-
0.92	0.8552	0.5785	1.0056	0.5817	-	-
0.94	0.8498	0.5658	1.0031	0.5675	-	-
0.96	0.8444	0.5532	1.0014	0.5539	-	-
0.98	0.8389	0.5407	1.0003	0.5409	-	-
1.00	0.8333	0.5283	1.0000	0.5283	90.000	0.000
-	-	-	-	-	-	-
1.02	0.8278	0.5160	1.0003	0.5162	78.635	0.126
1.04	0.8222	0.5039	1.0013	0.5045	74.058	0.351
1.06	0.8165	0.4919	1.0029	0.4933	70.630	0.637
1.08	0.8108	0.4800	1.0051	0.4825	67.808	0.968
1.10	0.8052	0.4684	1.0079	0.4721	65.380	1.336
-	-	-	-	-	-	-
1.12	0.7994	0.4568	1.0113	0.4620	63.234	1.735
1.14	0.7937	0.4455	1.0153	0.4523	61.306	2.160
1.16	0.7879	0.4343	1.0198	0.4428	59.550	2.607
1.18	0.7822	0.4232	1.0248	0.4337	57.936	3.074
1.20	0.7764	0.4124	1.0304	0.4249	56.443	3.558
-	-	-	-	-	-	-
1.22	0.7706	0.4017	1.0366	0.4164	55.052	4.057
1.24	0.7648	0.3912	1.0432	0.4081	53.751	4.569
1.26	0.7590	0.3809	1.0504	0.4001	52.528	5.093
1.28	0.7532	0.3708	1.0581	0.3924	51.375	5.627
1.30	0.7474	0.3609	1.0663	0.3848	50.285	6.170
-	-	-	-	-	-	-
1.32	0.7416	0.3512	1.0750	0.3775	49.251	6.721
1.34	0.7358	0.3417	1.0842	0.3704	48.268	7.279
1.36	0.7300	0.3323	1.0940	0.3636	47.332	7.844
1.38	0.7242	0.3232	1.1042	0.3569	46.439	8.413
1.40	0.7184	0.3142	1.1149	0.3504	45.585	8.987
-	-	-	-	-	-	-
1.42	0.7126	0.3055	1.1262	0.3440	44.767	9.565
1.44	0.7069	0.2969	1.1379	0.3379	43.983	10.146
1.46	0.7011	0.2886	1.1501	0.3319	43.230	10.731
1.48	0.6954	0.2804	1.1629	0.3261	42.507	11.317
1.50	0.6897	0.2724	1.1762	0.3204	41.810	11.905
-	-	-	-	-	-	-
1.52	0.6840	0.2646	1.1899	0.3149	41.140	12.495
1.54	0.6783	0.2570	1.2042	0.3095	40.493	13.086
1.56	0.6726	0.2496	1.2190	0.3042	39.868	13.677
1.58	0.6670	0.2423	1.2344	0.2991	39.265	14.269
1.60	0.6614	0.2353	1.2502	0.2941	38.682	14.860
1.62	0.6558	0.2284	1.2666	0.2893	38.118	15.452
1.64	0.6502	0.2217	1.2836	0.2845	37.572	16.043
1.66	0.6447	0.2151	1.3010	0.2799	37.043	16.633
1.68	0.6392	0.2088	1.3190	0.2754	36.530	17.222
1.70	0.6337	0.2026	1.3376	0.2710	36.032	17.810
-	-	-	-	-	-	-
1.72	0.6283	0.1966	1.3567	0.2667	35.549	18.396
1.74	0.6229	0.1907	1.3764	0.2625	35.080	18.981
1.76	0.6175	0.1850	1.3967	0.2584	34.624	19.565
1.78	0.6121	0.1794	1.4175	0.2544	34.180	20.146
1.80	0.6068	0.1740	1.4390	0.2504	33.749	20.725
-	-	-	-	-	-	-
1.82	0.6015	0.1688	1.4610	0.2466	33.329	21.302
1.84	0.5963	0.1637	1.4836	0.2429	32.921	21.877
1.86	0.5910	0.1587	1.5069	0.2392	32.523	22.449
1.88	0.5859	0.1539	1.5308	0.2356	32.135	23.019
1.90	0.5807	0.1492	1.5553	0.2321	31.757	23.586
-	-	-	-	-	-	-
1.92	0.5756	0.1447	1.5804	0.2287	31.388	24.151
1.94	0.5705	0.1403	1.6062	0.2253	31.028	24.712
1.96	0.5655	0.1360	1.6326	0.2220	30.677	25.271
1.98	0.5605	0.1318	1.6597	0.2188	30.335	25.827
2.00	0.5556	0.1278	1.6875	0.2157	30.000	26.380
-	-	-	-	-	-	-
2.02	0.5506	0.1239	1.7160	0.2126	29.673	26.930
2.04	0.5458	0.1201	1.7451	0.2096	29.353	27.476
2.06	0.5409	0.1164	1.7750	0.2066	29.041	28.020
2.08	0.5361	0.1128	1.8056	0.2037	28.736	28.560
2.10	0.5313	0.1094	1.8369	0.2009	28.437	29.097
-	-	-	-	-	-	-
2.12	0.5266	0.1060	1.8690	0.1981	28.145	29.631
2.14	0.5219	0.1027	1.9018	0.1954	27.859	30.161
2.16	0.5173	0.0996	1.9354	0.1927	27.578	30.688
2.18	0.5127	0.0965	1.9698	0.1901	27.304	31.212
2.20	0.5081	0.0935	2.0050	0.1875	27.036	31.732
-	-	-	-	-	-	-
2.22	0.5036	0.0906	2.0409	0.1850	26.773	32.249
2.24	0.4991	0.0878	2.0777	0.1825	26.515	32.763
2.26	0.4947	0.0851	2.1153	0.1801	26.262	33.273
2.28	0.4903	0.0825	2.1538	0.1777	26.014	33.780
2.30	0.4859	0.0800	2.1931	0.1754	25.771	34.283
-	-	-	-	-	-	-
2.32	0.4816	0.0775	2.2333	0.1731	25.533	34.782
2.34	0.4773	0.0751	2.2744	0.1709	25.300	35.279
2.36	0.4731	0.0728	2.3164	0.1687	25.070	35.771
2.38	0.4688	0.0706	2.3593	0.1665	24.845	36.261
2.40	0.4647	0.0684	2.4031	0.1644	24.624	36.747

Table A.2: Isentropic flow properties for $\gamma = 1.4$

M	T/T_0	P/P_0	A/A^*	PA/P_0A^*	μ	ν
2.42	0.4606	0.0663	2.4479	0.1623	24.407	37.229
2.44	0.4565	0.0643	2.4936	0.1602	24.195	37.708
2.46	0.4524	0.0623	2.5403	0.1582	23.985	38.183
2.48	0.4484	0.0604	2.5880	0.1563	23.780	38.655
2.50	0.4444	0.0585	2.6367	0.1543	23.578	39.124
-	-	-	-	-	-	-
2.52	0.4405	0.0567	2.6865	0.1524	23.380	39.589
2.54	0.4366	0.0550	2.7372	0.1505	23.185	40.050
2.56	0.4328	0.0533	2.7891	0.1487	22.993	40.508
2.58	0.4289	0.0517	2.8420	0.1469	22.805	40.963
2.60	0.4252	0.0501	2.8960	0.1451	22.620	41.415
-	-	-	-	-	-	-
2.62	0.4214	0.0486	2.9511	0.1434	22.438	41.863
2.64	0.4177	0.0471	3.0073	0.1417	22.259	42.307
2.66	0.4141	0.0457	3.0647	0.1400	22.082	42.749
2.68	0.4104	0.0443	3.1233	0.1383	21.909	43.187
2.70	0.4068	0.0430	3.1830	0.1367	21.738	43.621
-	-	-	-	-	-	-
2.72	0.4033	0.0417	3.2440	0.1351	21.571	44.053
2.74	0.3998	0.0404	3.3061	0.1335	21.405	44.481
2.76	0.3963	0.0392	3.3695	0.1320	21.243	44.906
2.78	0.3928	0.0380	3.4342	0.1305	21.083	45.327
2.80	0.3894	0.0368	3.5001	0.1290	20.925	45.746
-	-	-	-	-	-	-
2.82	0.3860	0.0357	3.5674	0.1275	20.770	46.161
2.84	0.3827	0.0347	3.6359	0.1261	20.617	46.573
2.86	0.3794	0.0336	3.7058	0.1246	20.466	46.982
2.88	0.3761	0.0326	3.7771	0.1232	20.318	47.388
2.90	0.3729	0.0317	3.8498	0.1219	20.171	47.790
-	-	-	-	-	-	-
2.92	0.3696	0.0307	3.9238	0.1205	20.027	48.190
2.94	0.3665	0.0298	3.9993	0.1192	19.885	48.586
2.96	0.3633	0.0289	4.0763	0.1178	19.745	48.980
2.98	0.3602	0.0281	4.1547	0.1166	19.607	49.370
3.00	0.3571	0.0272	4.2346	0.1153	19.471	49.757
-	-	-	-	-	-	-
3.02	0.3541	0.0264	4.3160	0.1140	19.337	50.142
3.04	0.3511	0.0256	4.3989	0.1128	19.205	50.523
3.06	0.3481	0.0249	4.4835	0.1116	19.075	50.902
3.08	0.3452	0.0242	4.5696	0.1104	18.946	51.277
3.10	0.3422	0.0234	4.6573	0.1092	18.819	51.650
-	-	-	-	-	-	-
3.12	0.3393	0.0228	4.7467	0.1080	18.694	52.020
3.14	0.3365	0.0221	4.8377	0.1069	18.571	52.386
3.16	0.3337	0.0215	4.9304	0.1058	18.449	52.751
3.18	0.3309	0.0208	5.0248	0.1047	18.329	53.112
3.20	0.3281	0.0202	5.1210	0.1036	18.210	53.470
3.22	0.3253	0.0196	5.2189	0.1025	18.093	53.826
3.24	0.3226	0.0191	5.3186	0.1015	17.977	54.179
3.26	0.3199	0.0185	5.4201	0.1004	17.863	54.529
3.28	0.3173	0.0180	5.5234	0.0994	17.751	54.877
3.30	0.3147	0.0175	5.6286	0.0984	17.640	55.222
-	-	-	-	-	-	-
3.32	0.3121	0.0170	5.7358	0.0974	17.530	55.564
3.34	0.3095	0.0165	5.8448	0.0964	17.422	55.904
3.36	0.3069	0.0160	5.9558	0.0954	17.315	56.241
3.38	0.3044	0.0156	6.0687	0.0945	17.209	56.576
3.40	0.3019	0.0151	6.1837	0.0935	17.105	56.908
-	-	-	-	-	-	-
3.42	0.2995	0.0147	6.3007	0.0926	17.002	57.237
3.44	0.2970	0.0143	6.4198	0.0917	16.900	57.564
3.46	0.2946	0.0139	6.5409	0.0908	16.799	57.888
3.48	0.2922	0.0135	6.6642	0.0899	16.700	58.210
3.50	0.2899	0.0131	6.7896	0.0890	16.602	58.530
-	-	-	-	-	-	-
3.52	0.2875	0.0127	6.9172	0.0882	16.505	58.847
3.54	0.2852	0.0124	7.0471	0.0873	16.409	59.162
3.56	0.2829	0.0120	7.1791	0.0865	16.314	59.474
3.58	0.2806	0.0117	7.3135	0.0856	16.220	59.784
3.60	0.2784	0.0114	7.4501	0.0848	16.128	60.091
-	-	-	-	-	-	-
3.62	0.2762	0.0111	7.5891	0.0840	16.036	60.397
3.64	0.2740	0.0108	7.7305	0.0832	15.946	60.700
3.66	0.2718	0.0105	7.8742	0.0824	15.856	61.001
3.68	0.2697	0.0102	8.0204	0.0817	15.768	61.299
3.70	0.2675	0.0099	8.1691	0.0809	15.680	61.595
-	-	-	-	-	-	-
3.72	0.2654	0.0096	8.3202	0.0801	15.594	61.889
3.74	0.2633	0.0094	8.4739	0.0794	15.508	62.181
3.76	0.2613	0.0091	8.6302	0.0787	15.424	62.471
3.78	0.2592	0.0089	8.7891	0.0779	15.340	62.758
3.80	0.2572	0.0086	8.9506	0.0772	15.258	63.044
-	-	-	-	-	-	-
3.82	0.2552	0.0084	9.1148	0.0765	15.176	63.327
3.84	0.2532	0.0082	9.2817	0.0758	15.095	63.608
3.86	0.2513	0.0080	9.4513	0.0752	15.015	63.887
3.88	0.2493	0.0077	9.6237	0.0745	14.936	64.164
3.90	0.2474	0.0075	9.7990	0.0738	14.857	64.440
-	-	-	-	-	-	-
3.92	0.2455	0.0073	9.9771	0.0731	14.780	64.713
3.94	0.2436	0.0071	10.1581	0.0725	14.703	64.984
3.96	0.2418	0.0069	10.3420	0.0719	14.627	65.253
3.98	0.2399	0.0068	10.5289	0.0712	14.552	65.520
4.00	0.2381	0.0066	10.7188	0.0706	14.478	65.785
4.02	0.2363	0.0064	10.9117	0.0700	14.404	66.048
4.04	0.2345	0.0062	11.1077	0.0694	14.331	66.309
4.06	0.2327	0.0061	11.3068	0.0688	14.259	66.569
4.08	0.2310	0.0059	11.5091	0.0682	14.188	66.826
4.10	0.2293	0.0058	11.7147	0.0676	14.117	67.082
-	-	-	-	-	-	-
4.12	0.2275	0.0056	11.9234	0.0670	14.047	67.336
4.14	0.2258	0.0055	12.1354	0.0664	13.978	67.588
4.16	0.2242	0.0053	12.3508	0.0659	13.909	67.838
4.18	0.2225	0.0052	12.5695	0.0653	13.841	68.087
4.20	0.2208	0.0051	12.7916	0.0648	13.774	68.333
-	-	-	-	-	-	-
4.22	0.2192	0.0049	13.0172	0.0642	13.708	68.578
4.24	0.2176	0.0048	13.2463	0.0637	13.642	68.821
4.26	0.2160	0.0047	13.4789	0.0631	13.576	69.063
4.28	0.2144	0.0046	13.7151	0.0626	13.512	69.303
4.30	0.2129	0.0044	13.9549	0.0621	13.448	69.541
-	-	-	-	-	-	-
4.32	0.2113	0.0043	14.1984	0.0616	13.384	69.777
4.34	0.2098	0.0042	14.4456	0.0611	13.321	70.012
4.36	0.2083	0.0041	14.6965	0.0606	13.259	70.245
4.38	0.2067	0.0040	14.9513	0.0601	13.198	70.476
4.40	0.2053	0.0039	15.2099	0.0596	13.137	70.706
-	-	-	-	-	-	-
4.42	0.2038	0.0038	15.4724	0.0591	13.076	70.934
4.44	0.2023	0.0037	15.7388	0.0586	13.016	71.161
4.46	0.2009	0.0036	16.0092	0.0582	12.957	71.386
4.48	0.1994	0.0035	16.2837	0.0577	12.898	71.610
4.50	0.1980	0.0035	16.5622	0.0572	12.840	71.832
-	-	-	-	-	-	-
4.52	0.1966	0.0034	16.8449	0.0568	12.782	72.052
4.54	0.1952	0.0033	17.1317	0.0563	12.725	72.271
4.56	0.1938	0.0032	17.4228	0.0559	12.668	72.489
4.58	0.1925	0.0031	17.7181	0.0554	12.612	72.705
4.60	0.1911	0.0031	18.0178	0.0550	12.556	72.919
-	-	-	-	-	-	-
4.62	0.1898	0.0030	18.3218	0.0546	12.501	73.132
4.64	0.1885	0.0029	18.6303	0.0541	12.446	73.344
4.66	0.1872	0.0028	18.9433	0.0537	12.392	73.554
4.68	0.1859	0.0028	19.2608	0.0533	12.338	73.763
4.70	0.1846	0.0027	19.5828	0.0529	12.284	73.970
-	-	-	-	-	-	-
4.72	0.1833	0.0026	19.9095	0.0525	12.232	74.176
4.74	0.1820	0.0026	20.2409	0.0521	12.179	74.381
4.76	0.1808	0.0025	20.5770	0.0517	12.127	74.584
4.78	0.1795	0.0025	20.9179	0.0513	12.076	74.786
4.80	0.1783	0.0024	21.2637	0.0509	12.025	74.986

Table B.1: Normal shock wave properties for $\gamma = 1.4$

M_1	M_2	T_2/T_1	P_2/P_1	P_{02}/P_{01}	P_{02}/P_1	$\Delta V/a_1$
1.02	0.9805	1.0132	1.0471	1.0000	1.9379	0.033
1.04	0.9620	1.0263	1.0952	0.9999	1.9844	0.065
1.06	0.9444	1.0393	1.1442	0.9998	2.0325	0.097
1.08	0.9277	1.0522	1.1941	0.9994	2.0819	0.128
1.10	0.9118	1.0649	1.2450	0.9989	2.1328	0.159
-	-	-	-	-	-	-
1.12	0.8966	1.0776	1.2968	0.9982	2.1851	0.189
1.14	0.8820	1.0903	1.3495	0.9973	2.2388	0.219
1.16	0.8682	1.1029	1.4032	0.9961	2.2937	0.248
1.18	0.8549	1.1154	1.4578	0.9946	2.3500	0.277
1.20	0.8422	1.1280	1.5133	0.9928	2.4075	0.306
-	-	-	-	-	-	-
1.22	0.8300	1.1405	1.5698	0.9907	2.4663	0.334
1.24	0.8183	1.1531	1.6272	0.9884	2.5263	0.361
1.26	0.8071	1.1657	1.6855	0.9857	2.5875	0.389
1.28	0.7963	1.1783	1.7448	0.9827	2.6500	0.416
1.30	0.7860	1.1909	1.8050	0.9794	2.7136	0.442
-	-	-	-	-	-	-
1.32	0.7760	1.2035	1.8661	0.9758	2.7784	0.469
1.34	0.7664	1.2162	1.9282	0.9718	2.8444	0.495
1.36	0.7572	1.2290	1.9912	0.9676	2.9115	0.521
1.38	0.7483	1.2418	2.0551	0.9630	2.9798	0.546
1.40	0.7397	1.2547	2.1200	0.9582	3.0492	0.571
-	-	-	-	-	-	-
1.42	0.7314	1.2676	2.1858	0.9531	3.1198	0.596
1.44	0.7235	1.2807	2.2525	0.9476	3.1915	0.621
1.46	0.7157	1.2938	2.3202	0.9420	3.2643	0.646
1.48	0.7083	1.3069	2.3888	0.9360	3.3382	0.670
1.50	0.7011	1.3202	2.4583	0.9298	3.4133	0.694
-	-	-	-	-	-	-
1.52	0.6941	1.3336	2.5288	0.9233	3.4894	0.718
1.54	0.6874	1.3470	2.6002	0.9166	3.5667	0.742
1.56	0.6809	1.3606	2.6725	0.9097	3.6450	0.766
1.58	0.6746	1.3742	2.7458	0.9026	3.7244	0.789
1.60	0.6684	1.3880	2.8200	0.8952	3.8050	0.813
-	-	-	-	-	-	-
1.62	0.6625	1.4018	2.8951	0.8877	3.8866	0.836
1.64	0.6568	1.4158	2.9712	0.8799	3.9693	0.859
1.66	0.6512	1.4299	3.0482	0.8720	4.0531	0.881
1.68	0.6458	1.4440	3.1261	0.8639	4.1379	0.904
1.70	0.6405	1.4583	3.2050	0.8557	4.2238	0.926
-	-	-	-	-	-	-
1.72	0.6355	1.4727	3.2848	0.8474	4.3108	0.949
1.74	0.6305	1.4873	3.3655	0.8389	4.3989	0.971
1.76	0.6257	1.5019	3.4472	0.8302	4.4880	0.993
1.78	0.6210	1.5167	3.5298	0.8215	4.5782	1.015
1.80	0.6165	1.5316	3.6133	0.8127	4.6695	1.037
1.82	0.6121	1.5466	3.6978	0.8038	4.7618	1.059
1.84	0.6078	1.5617	3.7832	0.7948	4.8552	1.080
1.86	0.6036	1.5770	3.8695	0.7857	4.9497	1.102
1.88	0.5996	1.5924	3.9568	0.7765	5.0452	1.123
1.90	0.5956	1.6079	4.0450	0.7674	5.1418	1.145
-	-	-	-	-	-	-
1.92	0.5918	1.6236	4.1341	0.7581	5.2394	1.166
1.94	0.5880	1.6394	4.2242	0.7488	5.3381	1.187
1.96	0.5844	1.6553	4.3152	0.7395	5.4378	1.208
1.98	0.5808	1.6713	4.4071	0.7302	5.5386	1.229
2.00	0.5774	1.6875	4.5000	0.7209	5.6404	1.250
-	-	-	-	-	-	-
2.02	0.5740	1.7038	4.5938	0.7115	5.7433	1.271
2.04	0.5707	1.7203	4.6885	0.7022	5.8473	1.292
2.06	0.5675	1.7369	4.7842	0.6928	5.9523	1.312
2.08	0.5643	1.7536	4.8808	0.6835	6.0583	1.333
2.10	0.5613	1.7705	4.9783	0.6742	6.1654	1.353
-	-	-	-	-	-	-
2.12	0.5583	1.7875	5.0768	0.6649	6.2735	1.374
2.14	0.5554	1.8046	5.1762	0.6557	6.3827	1.394
2.16	0.5525	1.8219	5.2765	0.6464	6.4929	1.414
2.18	0.5498	1.8393	5.3778	0.6373	6.6042	1.434
2.20	0.5471	1.8569	5.4800	0.6281	6.7165	1.455
-	-	-	-	-	-	-
2.22	0.5444	1.8746	5.5831	0.6191	6.8298	1.475
2.24	0.5418	1.8924	5.6872	0.6100	6.9442	1.495
2.26	0.5393	1.9104	5.7922	0.6011	7.0597	1.515
2.28	0.5368	1.9285	5.8981	0.5921	7.1762	1.535
2.30	0.5344	1.9468	6.0050	0.5833	7.2937	1.554
-	-	-	-	-	-	-
2.32	0.5321	1.9652	6.1128	0.5745	7.4122	1.574
2.34	0.5297	1.9838	6.2215	0.5658	7.5319	1.594
2.36	0.5275	2.0025	6.3312	0.5572	7.6525	1.614
2.38	0.5253	2.0213	6.4418	0.5486	7.7742	1.633
2.40	0.5231	2.0403	6.5533	0.5401	7.8969	1.653
-	-	-	-	-	-	-
2.42	0.5210	2.0595	6.6658	0.5317	8.0207	1.672
2.44	0.5189	2.0788	6.7792	0.5234	8.1455	1.692
2.46	0.5169	2.0982	6.8935	0.5152	8.2713	1.711
2.48	0.5149	2.1178	7.0088	0.5071	8.3982	1.731
2.50	0.5130	2.1375	7.1250	0.4990	8.5261	1.750
-	-	-	-	-	-	-
2.52	0.5111	2.1574	7.2421	0.4911	8.6551	1.769
2.54	0.5092	2.1774	7.3602	0.4832	8.7851	1.789
2.56	0.5074	2.1976	7.4792	0.4754	8.9161	1.808
2.58	0.5056	2.2179	7.5991	0.4677	9.0482	1.827
2.60	0.5039	2.2383	7.7200	0.4601	9.1813	1.846
2.62	0.5022	2.2590	7.8418	0.4526	9.3155	1.865
2.64	0.5005	2.2797	7.9645	0.4452	9.4506	1.884
2.66	0.4988	2.3006	8.0882	0.4379	9.5869	1.903
2.68	0.4972	2.3217	8.2128	0.4307	9.7241	1.922
2.70	0.4956	2.3429	8.3383	0.4236	9.8624	1.941
-	-	-	-	-	-	-
2.72	0.4941	2.3642	8.4648	0.4166	10.0017	1.960
2.74	0.4926	2.3858	8.5922	0.4097	10.1421	1.979
2.76	0.4911	2.4074	8.7205	0.4028	10.2835	1.998
2.78	0.4896	2.4292	8.8498	0.3961	10.4259	2.017
2.80	0.4882	2.4512	8.9800	0.3895	10.5694	2.036
-	-	-	-	-	-	-
2.82	0.4868	2.4733	9.1111	0.3829	10.7139	2.054
2.84	0.4854	2.4955	9.2432	0.3765	10.8594	2.073
2.86	0.4840	2.5179	9.3762	0.3701	11.0060	2.092
2.88	0.4827	2.5405	9.5101	0.3639	11.1536	2.111
2.90	0.4814	2.5632	9.6450	0.3577	11.3022	2.129
-	-	-	-	-	-	-
2.92	0.4801	2.5861	9.7808	0.3517	11.4519	2.148
2.94	0.4788	2.6091	9.9175	0.3457	11.6026	2.167
2.96	0.4776	2.6322	10.0552	0.3398	11.7544	2.185
2.98	0.4764	2.6555	10.1938	0.3340	11.9072	2.204
3.00	0.4752	2.6790	10.3333	0.3283	12.0610	2.222
-	-	-	-	-	-	-
3.02	0.4740	2.7026	10.4738	0.3227	12.2158	2.241
3.04	0.4729	2.7264	10.6152	0.3172	12.3717	2.259
3.06	0.4717	2.7503	10.7575	0.3118	12.5286	2.278
3.08	0.4706	2.7744	10.9008	0.3065	12.6865	2.296
3.10	0.4695	2.7986	11.0450	0.3012	12.8455	2.315
-	-	-	-	-	-	-
3.12	0.4685	2.8230	11.1901	0.2960	13.0055	2.333
3.14	0.4674	2.8475	11.3362	0.2910	13.1666	2.351
3.16	0.4664	2.8722	11.4832	0.2860	13.3287	2.370
3.18	0.4654	2.8970	11.6311	0.2811	13.4918	2.388
3.20	0.4643	2.9220	11.7800	0.2762	13.6559	2.406
-	-	-	-	-	-	-
3.22	0.4634	2.9471	11.9298	0.2715	13.8211	2.425
3.24	0.4624	2.9724	12.0805	0.2668	13.9873	2.443
3.26	0.4614	2.9979	12.2322	0.2622	14.1546	2.461
3.28	0.4605	3.0234	12.3848	0.2577	14.3228	2.479
3.30	0.4596	3.0492	12.5383	0.2533	14.4921	2.497
-	-	-	-	-	-	-
3.32	0.4587	3.0751	12.6928	0.2489	14.6625	2.516
3.34	0.4578	3.1011	12.8482	0.2446	14.8339	2.534
3.36	0.4569	3.1273	13.0045	0.2404	15.0063	2.552
3.38	0.4560	3.1537	13.1618	0.2363	15.1797	2.570
3.40	0.4552	3.1802	13.3200	0.2322	15.3542	2.588

Table B.2: Normal shock wave properties for $\gamma = 1.4$

M_1	M_2	T_2/T_1	P_2/P_1	P_{02}/P_{01}	P_{02}/P_1	$\Delta V/a_1$
3.42	0.4544	3.2069	13.4791	0.2282	15.5297	2.606
3.44	0.4535	3.2337	13.6392	0.2243	15.7062	2.624
3.46	0.4527	3.2607	13.8002	0.2205	15.8838	2.642
3.48	0.4519	3.2878	13.9621	0.2167	16.0624	2.661
3.50	0.4512	3.3151	14.1250	0.2129	16.2420	2.679
-	-	-	-	-	-	-
3.52	0.4504	3.3425	14.2888	0.2093	16.4227	2.697
3.54	0.4496	3.3701	14.4535	0.2057	16.6044	2.715
3.56	0.4489	3.3978	14.6192	0.2022	16.7871	2.733
3.58	0.4481	3.4257	14.7858	0.1987	16.9708	2.751
3.60	0.4474	3.4537	14.9533	0.1953	17.1556	2.769
-	-	-	-	-	-	-
3.62	0.4467	3.4819	15.1218	0.1920	17.3415	2.786
3.64	0.4460	3.5103	15.2912	0.1887	17.5283	2.804
3.66	0.4453	3.5388	15.4615	0.1855	17.7162	2.822
3.68	0.4446	3.5674	15.6328	0.1823	17.9051	2.840
3.70	0.4439	3.5962	15.8050	0.1792	18.0951	2.858
-	-	-	-	-	-	-
3.72	0.4433	3.6252	15.9781	0.1761	18.2860	2.876
3.74	0.4426	3.6543	16.1522	0.1731	18.4781	2.894
3.76	0.4420	3.6836	16.3272	0.1702	18.6711	2.912
3.78	0.4414	3.7130	16.5031	0.1673	18.8652	2.930
3.80	0.4407	3.7426	16.6800	0.1645	19.0603	2.947
-	-	-	-	-	-	-
3.82	0.4401	3.7723	16.8578	0.1617	19.2564	2.965
3.84	0.4395	3.8022	17.0365	0.1589	19.4536	2.983
3.86	0.4389	3.8323	17.2162	0.1563	19.6518	3.001
3.88	0.4383	3.8625	17.3968	0.1536	19.8510	3.019
3.90	0.4377	3.8928	17.5783	0.1510	20.0513	3.036
-	-	-	-	-	-	-
3.92	0.4372	3.9233	17.7608	0.1485	20.2526	3.054
3.94	0.4366	3.9540	17.9442	0.1460	20.4549	3.072
3.96	0.4360	3.9848	18.1285	0.1435	20.6583	3.090
3.98	0.4355	4.0158	18.3138	0.1411	20.8627	3.107
4.00	0.4350	4.0469	18.5000	0.1388	21.0681	3.125
-	-	-	-	-	-	-
4.02	0.4344	4.0782	18.6871	0.1364	21.2745	3.143
4.04	0.4339	4.1096	18.8752	0.1342	21.4820	3.160
4.06	0.4334	4.1412	19.0642	0.1319	21.6905	3.178
4.08	0.4329	4.1729	19.2541	0.1297	21.9001	3.196
4.10	0.4324	4.2048	19.4450	0.1276	22.1106	3.213
-	-	-	-	-	-	-
4.12	0.4319	4.2368	19.6368	0.1254	22.3223	3.231
4.14	0.4314	4.2690	19.8295	0.1234	22.5349	3.249
4.16	0.4309	4.3014	20.0232	0.1213	22.7486	3.266
4.18	0.4304	4.3339	20.2178	0.1193	22.9633	3.284
4.20	0.4299	4.3666	20.4133	0.1173	23.1790	3.302

M_1	M_2	T_2/T_1	P_2/P_1	P_{02}/P_{01}	P_{02}/P_1	$\Delta V/a_1$
4.22	0.4295	4.3994	20.6098	0.1154	23.3958	3.319
4.24	0.4290	4.4324	20.8072	0.1135	23.6135	3.337
4.26	0.4286	4.4655	21.0055	0.1116	23.8324	3.354
4.28	0.4281	4.4988	21.2048	0.1098	24.0522	3.372
4.30	0.4277	4.5322	21.4050	0.1080	24.2731	3.390
-	-	-	-	-	-	-
4.32	0.4272	4.5658	21.6061	0.1062	24.4950	3.407
4.34	0.4268	4.5995	21.8082	0.1045	24.7180	3.425
4.36	0.4264	4.6334	22.0112	0.1028	24.9420	3.442
4.38	0.4260	4.6675	22.2151	0.1011	25.1670	3.460
4.40	0.4255	4.7017	22.4200	0.0995	25.3930	3.477
-	-	-	-	-	-	-
4.42	0.4251	4.7361	22.6258	0.0979	25.6201	3.495
4.44	0.4247	4.7706	22.8325	0.0963	25.8482	3.512
4.46	0.4243	4.8053	23.0402	0.0947	26.0773	3.530
4.48	0.4239	4.8401	23.2488	0.0932	26.3075	3.547
4.50	0.4236	4.8751	23.4583	0.0917	26.5387	3.565
-	-	-	-	-	-	-
4.52	0.4232	4.9102	23.6688	0.0902	26.7709	3.582
4.54	0.4228	4.9455	23.8802	0.0888	27.0041	3.600
4.56	0.4224	4.9810	24.0925	0.0874	27.2384	3.617
4.58	0.4220	5.0166	24.3058	0.0860	27.4737	3.635
4.60	0.4217	5.0523	24.5200	0.0846	27.7101	3.652
-	-	-	-	-	-	-
4.62	0.4213	5.0882	24.7351	0.0832	27.9475	3.670
4.64	0.4210	5.1243	24.9512	0.0819	28.1859	3.687
4.66	0.4206	5.1605	25.1682	0.0806	28.4253	3.705
4.68	0.4203	5.1969	25.3861	0.0793	28.6658	3.722
4.70	0.4199	5.2334	25.6050	0.0781	28.9073	3.739
-	-	-	-	-	-	-
4.72	0.4196	5.2701	25.8248	0.0769	29.1498	3.757
4.74	0.4192	5.3070	26.0455	0.0756	29.3934	3.774
4.76	0.4189	5.3440	26.2672	0.0745	29.6380	3.792
4.78	0.4186	5.3811	26.4898	0.0733	29.8836	3.809
4.80	0.4183	5.4184	26.7133	0.0721	30.1303	3.826
-	-	-	-	-	-	-
4.82	0.4179	5.4559	26.9378	0.0710	30.3779	3.844
4.84	0.4176	5.4935	27.1632	0.0699	30.6267	3.861
4.86	0.4173	5.5313	27.3895	0.0688	30.8764	3.879
4.88	0.4170	5.5692	27.6168	0.0677	31.1272	3.896
4.90	0.4167	5.6073	27.8450	0.0667	31.3790	3.913
-	-	-	-	-	-	-
4.92	0.4164	5.6455	28.0741	0.0657	31.6318	3.931
4.94	0.4161	5.6839	28.3042	0.0647	31.8857	3.948
4.96	0.4158	5.7224	28.5352	0.0637	32.1406	3.965
4.98	0.4155	5.7611	28.7671	0.0627	32.3965	3.983
5.00	0.4152	5.8000	29.0000	0.0617	32.6535	4.000

M_1	M_2	T_2/T_1	P_2/P_1	P_{02}/P_{01}	P_{02}/P_1	$\Delta V/a_1$
5.02	0.4149	5.8390	29.2338	0.0608	32.9115	4.017
5.04	0.4147	5.8782	29.4685	0.0598	33.1705	4.035
5.06	0.4144	5.9175	29.7042	0.0589	33.4305	4.052
5.08	0.4141	5.9570	29.9408	0.0580	33.6916	4.069
5.10	0.4138	5.9966	30.1783	0.0572	33.9537	4.087
-	-	-	-	-	-	-
5.12	0.4136	6.0364	30.4168	0.0563	34.2169	4.104
5.14	0.4133	6.0763	30.6562	0.0554	34.4810	4.121
5.16	0.4130	6.1164	30.8965	0.0546	34.7462	4.139
5.18	0.4128	6.1567	31.1378	0.0538	35.0125	4.156
5.20	0.4125	6.1971	31.3800	0.0530	35.2797	4.173
-	-	-	-	-	-	-
5.22	0.4123	6.2376	31.6231	0.0522	35.5480	4.190
5.24	0.4120	6.2784	31.8672	0.0514	35.8174	4.208
5.26	0.4118	6.3192	32.1122	0.0506	36.0877	4.225
5.28	0.4115	6.3603	32.3581	0.0499	36.3591	4.242
5.30	0.4113	6.4014	32.6050	0.0491	36.6315	4.259
-	-	-	-	-	-	-
5.32	0.4110	6.4428	32.8528	0.0484	36.9050	4.277
5.34	0.4108	6.4843	33.1015	0.0477	37.1794	4.294
5.36	0.4106	6.5259	33.3512	0.0470	37.4550	4.311
5.38	0.4103	6.5677	33.6018	0.0463	37.7315	4.328
5.40	0.4101	6.6097	33.8533	0.0456	38.0091	4.346
-	-	-	-	-	-	-
5.42	0.4099	6.6518	34.1058	0.0449	38.2877	4.363
5.44	0.4096	6.6941	34.3592	0.0443	38.5673	4.380
5.46	0.4094	6.7365	34.6135	0.0436	38.8479	4.397
5.48	0.4092	6.7791	34.8688	0.0430	39.1296	4.415
5.50	0.4090	6.8218	35.1250	0.0424	39.4124	4.432
-	-	-	-	-	-	-
5.52	0.4088	6.8647	35.3821	0.0417	39.6961	4.449
5.54	0.4085	6.9077	35.6402	0.0411	39.9809	4.466
5.56	0.4083	6.9509	35.8992	0.0405	40.2667	4.483
5.58	0.4081	6.9943	36.1591	0.0400	40.5535	4.501
5.60	0.4079	7.0378	36.4200	0.0394	40.8414	4.518
-	-	-	-	-	-	-
5.62	0.4077	7.0815	36.6818	0.0388	41.1303	4.535
5.64	0.4075	7.1253	36.9445	0.0383	41.4202	4.552
5.66	0.4073	7.1693	37.2082	0.0377	41.7112	4.569
5.68	0.4071	7.2134	37.4728	0.0372	42.0032	4.587
5.70	0.4069	7.2577	37.7383	0.0366	42.2962	4.604
-	-	-	-	-	-	-
5.72	0.4067	7.3021	38.0048	0.0361	42.5903	4.621
5.74	0.4065	7.3467	38.2722	0.0356	42.8854	4.638
5.76	0.4063	7.3915	38.5405	0.0351	43.1815	4.655
5.78	0.4061	7.4364	38.8098	0.0346	43.4786	4.672
5.80	0.4059	7.4814	39.0800	0.0341	43.7768	4.690

Table D.1: Fanno flow properties for $\gamma = 1.4$

M	T/T^*	P/P^*	ρ/ρ^*	P_0/P_0^*	$4fL^*/D$
0.02	1.1999	54.7701	45.6454	28.9421	1778.4499
0.04	1.1996	27.3817	22.8254	14.4815	440.3522
0.06	1.1991	18.2508	15.2200	9.6659	193.0311
0.08	1.1985	13.6843	11.4182	7.2616	106.7182
0.10	1.1976	10.9435	9.1378	5.8218	66.9216
-	-	-	-	-	-
0.12	1.1966	9.1156	7.6182	4.8643	45.4080
0.14	1.1953	7.8093	6.5333	4.1824	32.5113
0.16	1.1939	6.8291	5.7200	3.6727	24.1978
0.18	1.1923	6.0662	5.0879	3.2779	18.5427
0.20	1.1905	5.4554	4.5826	2.9635	14.5333
-	-	-	-	-	-
0.22	1.1885	4.9554	4.1694	2.7076	11.5961
0.24	1.1863	4.5383	3.8255	2.4956	9.3865
0.26	1.1840	4.1851	3.5347	2.3173	7.6876
0.28	1.1815	3.8820	3.2857	2.1656	6.3572
0.30	1.1788	3.6191	3.0702	2.0351	5.2993
-	-	-	-	-	-
0.32	1.1759	3.3887	2.8818	1.9219	4.4467
0.34	1.1729	3.1853	2.7158	1.8229	3.7520
0.36	1.1697	3.0042	2.5684	1.7358	3.1801
0.38	1.1663	2.8420	2.4367	1.6587	2.7054
0.40	1.1628	2.6958	2.3184	1.5901	2.3085
-	-	-	-	-	-
0.42	1.1591	2.5634	2.2115	1.5289	1.9744
0.44	1.1553	2.4428	2.1145	1.4740	1.6915
0.46	1.1513	2.3326	2.0261	1.4246	1.4509
0.48	1.1471	2.2313	1.9451	1.3801	1.2453
0.50	1.1429	2.1381	1.8708	1.3398	1.0691
-	-	-	-	-	-
0.52	1.1384	2.0519	1.8024	1.3034	0.9174
0.54	1.1339	1.9719	1.7391	1.2703	0.7866
0.56	1.1292	1.8975	1.6805	1.2403	0.6736
0.58	1.1244	1.8282	1.6260	1.2130	0.5757
0.60	1.1194	1.7634	1.5753	1.1882	0.4908
-	-	-	-	-	-
0.62	1.1143	1.7026	1.5279	1.1656	0.4172
0.64	1.1091	1.6456	1.4836	1.1451	0.3533
0.66	1.1038	1.5919	1.4421	1.1265	0.2979
0.68	1.0984	1.5413	1.4032	1.1097	0.2498
0.70	1.0929	1.4935	1.3665	1.0944	0.2081
-	-	-	-	-	-
0.72	1.0873	1.4482	1.3320	1.0806	0.1721
0.74	1.0815	1.4054	1.2994	1.0681	0.1411
0.76	1.0757	1.3647	1.2686	1.0570	0.1145
0.78	1.0698	1.3261	1.2395	1.0471	0.0917
0.80	1.0638	1.2893	1.2119	1.0382	0.0723
0.82	1.0578	1.2542	1.1858	1.0305	0.0559
0.84	1.0516	1.2208	1.1609	1.0237	0.0423
0.86	1.0454	1.1889	1.1373	1.0179	0.0310
0.88	1.0391	1.1583	1.1148	1.0129	0.0218
0.90	1.0327	1.1291	1.0934	1.0089	0.0145
-	-	-	-	-	-
0.92	1.0263	1.1011	1.0730	1.0056	0.0089
0.94	1.0198	1.0743	1.0535	1.0031	0.0048
0.96	1.0132	1.0485	1.0348	1.0014	0.0021
0.98	1.0066	1.0238	1.0170	1.0003	0.0005
1.00	1.0000	1.0000	1.0000	1.0000	0.0000
-	-	-	-	-	-
1.02	0.9933	0.9771	0.9837	1.0003	0.0005
1.04	0.9866	0.9551	0.9681	1.0013	0.0018
1.06	0.9798	0.9338	0.9531	1.0029	0.0038
1.08	0.9730	0.9133	0.9387	1.0051	0.0066
1.10	0.9662	0.8936	0.9249	1.0079	0.0099
-	-	-	-	-	-
1.12	0.9593	0.8745	0.9116	1.0113	0.0138
1.14	0.9524	0.8561	0.8988	1.0153	0.0182
1.16	0.9455	0.8383	0.8865	1.0198	0.0230
1.18	0.9386	0.8210	0.8747	1.0248	0.0281
1.20	0.9317	0.8044	0.8633	1.0304	0.0336
-	-	-	-	-	-
1.22	0.9247	0.7882	0.8524	1.0366	0.0394
1.24	0.9178	0.7726	0.8418	1.0432	0.0455
1.26	0.9108	0.7574	0.8316	1.0504	0.0517
1.28	0.9038	0.7427	0.8218	1.0581	0.0582
1.30	0.8969	0.7285	0.8123	1.0663	0.0648
-	-	-	-	-	-
1.32	0.8899	0.7147	0.8031	1.0750	0.0716
1.34	0.8829	0.7012	0.7942	1.0842	0.0785
1.36	0.8760	0.6882	0.7856	1.0940	0.0855
1.38	0.8690	0.6755	0.7773	1.1042	0.0926
1.40	0.8621	0.6632	0.7693	1.1149	0.0997
-	-	-	-	-	-
1.42	0.8551	0.6512	0.7615	1.1262	0.1069
1.44	0.8482	0.6396	0.7540	1.1379	0.1142
1.46	0.8413	0.6282	0.7467	1.1501	0.1215
1.48	0.8344	0.6172	0.7397	1.1629	0.1288
1.50	0.8276	0.6065	0.7328	1.1762	0.1361
-	-	-	-	-	-
1.52	0.8207	0.5960	0.7262	1.1899	0.1433
1.54	0.8139	0.5858	0.7198	1.2042	0.1506
1.56	0.8071	0.5759	0.7135	1.2190	0.1579
1.58	0.8004	0.5662	0.7074	1.2344	0.1651
1.60	0.7937	0.5568	0.7016	1.2502	0.1724
1.62	0.7869	0.5476	0.6958	1.2666	0.1795
1.64	0.7803	0.5386	0.6903	1.2836	0.1867
1.66	0.7736	0.5299	0.6849	1.3010	0.1938
1.68	0.7670	0.5213	0.6796	1.3190	0.2008
1.70	0.7605	0.5130	0.6745	1.3376	0.2078
-	-	-	-	-	-
1.72	0.7539	0.5048	0.6696	1.3567	0.2147
1.74	0.7474	0.4969	0.6648	1.3764	0.2216
1.76	0.7410	0.4891	0.6601	1.3967	0.2284
1.78	0.7345	0.4815	0.6555	1.4175	0.2352
1.80	0.7282	0.4741	0.6511	1.4390	0.2419
-	-	-	-	-	-
1.82	0.7218	0.4668	0.6467	1.4610	0.2485
1.84	0.7155	0.4597	0.6425	1.4836	0.2551
1.86	0.7093	0.4528	0.6384	1.5069	0.2616
1.88	0.7030	0.4460	0.6344	1.5308	0.2680
1.90	0.6969	0.4394	0.6305	1.5553	0.2743
-	-	-	-	-	-
1.92	0.6907	0.4329	0.6267	1.5804	0.2806
1.94	0.6847	0.4265	0.6230	1.6062	0.2868
1.96	0.6786	0.4203	0.6193	1.6326	0.2929
1.98	0.6726	0.4142	0.6158	1.6597	0.2990
2.00	0.6667	0.4082	0.6124	1.6875	0.3050
-	-	-	-	-	-
2.02	0.6608	0.4024	0.6090	1.7160	0.3109
2.04	0.6549	0.3967	0.6057	1.7451	0.3168
2.06	0.6491	0.3911	0.6025	1.7750	0.3225
2.08	0.6433	0.3856	0.5994	1.8056	0.3282
2.10	0.6376	0.3802	0.5963	1.8369	0.3339
-	-	-	-	-	-
2.12	0.6320	0.3750	0.5934	1.8690	0.3394
2.14	0.6263	0.3698	0.5905	1.9018	0.3449
2.16	0.6208	0.3648	0.5876	1.9354	0.3503
2.18	0.6152	0.3598	0.5848	1.9698	0.3556
2.20	0.6098	0.3549	0.5821	2.0050	0.3609
-	-	-	-	-	-
2.22	0.6043	0.3502	0.5794	2.0409	0.3661
2.24	0.5989	0.3455	0.5768	2.0777	0.3712
2.26	0.5936	0.3409	0.5743	2.1153	0.3763
2.28	0.5883	0.3364	0.5718	2.1538	0.3813
2.30	0.5831	0.3320	0.5694	2.1931	0.3862
-	-	-	-	-	-
2.32	0.5779	0.3277	0.5670	2.2333	0.3911
2.34	0.5728	0.3234	0.5647	2.2744	0.3959
2.36	0.5677	0.3193	0.5624	2.3164	0.4006
2.38	0.5626	0.3152	0.5602	2.3593	0.4053
2.40	0.5576	0.3111	0.5580	2.4031	0.4099

Table D.2: Fanno flow properties for $\gamma = 1.4$

M	T/T^*	P/P^*	ρ/ρ^*	P_0/P_0^*	$4fL^*/D$
2.42	0.5527	0.3072	0.5558	2.4479	0.4144
2.44	0.5478	0.3033	0.5537	2.4936	0.4189
2.46	0.5429	0.2995	0.5517	2.5403	0.4233
2.48	0.5381	0.2958	0.5497	2.5880	0.4277
2.50	0.5333	0.2921	0.5477	2.6367	0.4320
-	-	-	-	-	-
2.52	0.5286	0.2885	0.5458	2.6865	0.4362
2.54	0.5239	0.2850	0.5439	2.7372	0.4404
2.56	0.5193	0.2815	0.5421	2.7891	0.4445
2.58	0.5147	0.2781	0.5402	2.8420	0.4486
2.60	0.5102	0.2747	0.5385	2.8960	0.4526
-	-	-	-	-	-
2.62	0.5057	0.2714	0.5367	2.9511	0.4565
2.64	0.5013	0.2682	0.5350	3.0073	0.4604
2.66	0.4969	0.2650	0.5333	3.0647	0.4643
2.68	0.4925	0.2619	0.5317	3.1233	0.4681
2.70	0.4882	0.2588	0.5301	3.1830	0.4718
-	-	-	-	-	-
2.72	0.4839	0.2558	0.5285	3.2440	0.4755
2.74	0.4797	0.2528	0.5269	3.3061	0.4791
2.76	0.4755	0.2498	0.5254	3.3695	0.4827
2.78	0.4714	0.2470	0.5239	3.4342	0.4863
2.80	0.4673	0.2441	0.5225	3.5001	0.4898
-	-	-	-	-	-
2.82	0.4632	0.2414	0.5210	3.5674	0.4932
2.84	0.4592	0.2386	0.5196	3.6359	0.4966
2.86	0.4552	0.2359	0.5182	3.7058	0.5000
2.88	0.4513	0.2333	0.5169	3.7771	0.5033
2.90	0.4474	0.2307	0.5155	3.8498	0.5065
-	-	-	-	-	-
2.92	0.4436	0.2281	0.5142	3.9238	0.5097
2.94	0.4398	0.2256	0.5129	3.9993	0.5129
2.96	0.4360	0.2231	0.5116	4.0763	0.5160
2.98	0.4323	0.2206	0.5104	4.1547	0.5191
3.00	0.4286	0.2182	0.5092	4.2346	0.5222
-	-	-	-	-	-
3.02	0.4249	0.2158	0.5080	4.3160	0.5252
3.04	0.4213	0.2135	0.5068	4.3989	0.5281
3.06	0.4177	0.2112	0.5056	4.4835	0.5310
3.08	0.4142	0.2090	0.5045	4.5696	0.5339
3.10	0.4107	0.2067	0.5034	4.6573	0.5368
-	-	-	-	-	-
3.12	0.4072	0.2045	0.5023	4.7467	0.5396
3.14	0.4038	0.2024	0.5012	4.8377	0.5424
3.16	0.4004	0.2002	0.5001	4.9304	0.5451
3.18	0.3970	0.1981	0.4991	5.0248	0.5478
3.20	0.3937	0.1961	0.4980	5.1210	0.5504

M	T/T^*	P/P^*	ρ/ρ^*	P_0/P_0^*	$4fL^*/D$
3.22	0.3904	0.1940	0.4970	5.2189	0.5531
3.24	0.3872	0.1920	0.4960	5.3186	0.5557
3.26	0.3839	0.1901	0.4951	5.4201	0.5582
3.28	0.3807	0.1881	0.4941	5.5234	0.5607
3.30	0.3776	0.1862	0.4931	5.6286	0.5632
-	-	-	-	-	-
3.32	0.3745	0.1843	0.4922	5.7358	0.5657
3.34	0.3714	0.1825	0.4913	5.8448	0.5681
3.36	0.3683	0.1806	0.4904	5.9558	0.5705
3.38	0.3653	0.1788	0.4895	6.0687	0.5729
3.40	0.3623	0.1770	0.4886	6.1837	0.5752
-	-	-	-	-	-
3.42	0.3594	0.1753	0.4878	6.3007	0.5775
3.44	0.3564	0.1736	0.4869	6.4198	0.5798
3.46	0.3535	0.1718	0.4861	6.5409	0.5820
3.48	0.3507	0.1702	0.4853	6.6642	0.5842
3.50	0.3478	0.1685	0.4845	6.7896	0.5864
-	-	-	-	-	-
3.52	0.3450	0.1669	0.4837	6.9172	0.5886
3.54	0.3422	0.1653	0.4829	7.0471	0.5907
3.56	0.3395	0.1637	0.4821	7.1791	0.5928
3.58	0.3368	0.1621	0.4813	7.3135	0.5949
3.60	0.3341	0.1606	0.4806	7.4501	0.5970
-	-	-	-	-	-
3.62	0.3314	0.1590	0.4799	7.5891	0.5990
3.64	0.3288	0.1575	0.4791	7.7305	0.6010
3.66	0.3262	0.1560	0.4784	7.8742	0.6030
3.68	0.3236	0.1546	0.4777	8.0204	0.6049
3.70	0.3210	0.1531	0.4770	8.1691	0.6068
-	-	-	-	-	-
3.72	0.3185	0.1517	0.4763	8.3202	0.6087
3.74	0.3160	0.1503	0.4757	8.4739	0.6106
3.76	0.3135	0.1489	0.4750	8.6302	0.6125
3.78	0.3111	0.1475	0.4743	8.7891	0.6143
3.80	0.3086	0.1462	0.4737	8.9506	0.6161
-	-	-	-	-	-
3.82	0.3062	0.1449	0.4730	9.1148	0.6179
3.84	0.3039	0.1436	0.4724	9.2817	0.6197
3.86	0.3015	0.1423	0.4718	9.4513	0.6214
3.88	0.2992	0.1410	0.4712	9.6237	0.6231
3.90	0.2969	0.1397	0.4706	9.7990	0.6248
-	-	-	-	-	-
3.92	0.2946	0.1385	0.4700	9.9771	0.6265
3.94	0.2923	0.1372	0.4694	10.1581	0.6282
3.96	0.2901	0.1360	0.4688	10.3420	0.6298
3.98	0.2879	0.1348	0.4683	10.5289	0.6315
4.00	0.2857	0.1336	0.4677	10.7188	0.6331

M	T/T^*	P/P^*	ρ/ρ^*	P_0/P_0^*	$4fL^*/D$
4.02	0.2835	0.1325	0.4672	10.9117	0.6346
4.04	0.2814	0.1313	0.4666	11.1077	0.6362
4.06	0.2793	0.1302	0.4661	11.3068	0.6378
4.08	0.2772	0.1290	0.4655	11.5091	0.6393
4.10	0.2751	0.1279	0.4650	11.7147	0.6408
-	-	-	-	-	-
4.12	0.2730	0.1268	0.4645	11.9234	0.6423
4.14	0.2710	0.1257	0.4640	12.1354	0.6438
4.16	0.2690	0.1247	0.4635	12.3508	0.6452
4.18	0.2670	0.1236	0.4630	12.5695	0.6467
4.20	0.2650	0.1226	0.4625	12.7916	0.6481
-	-	-	-	-	-
4.22	0.2631	0.1215	0.4620	13.0172	0.6495
4.24	0.2611	0.1205	0.4615	13.2463	0.6509
4.26	0.2592	0.1195	0.4611	13.4789	0.6523
4.28	0.2573	0.1185	0.4606	13.7151	0.6536
4.30	0.2554	0.1175	0.4601	13.9549	0.6550
-	-	-	-	-	-
4.32	0.2536	0.1166	0.4597	14.1984	0.6563
4.34	0.2517	0.1156	0.4592	14.4456	0.6576
4.36	0.2499	0.1147	0.4588	14.6965	0.6589
4.38	0.2481	0.1137	0.4584	14.9513	0.6602
4.40	0.2463	0.1128	0.4579	15.2099	0.6615
-	-	-	-	-	-
4.42	0.2445	0.1119	0.4575	15.4724	0.6627
4.44	0.2428	0.1110	0.4571	15.7388	0.6640
4.46	0.2410	0.1101	0.4567	16.0092	0.6652
4.48	0.2393	0.1092	0.4563	16.2837	0.6664
4.50	0.2376	0.1083	0.4559	16.5622	0.6676
-	-	-	-	-	-
4.52	0.2359	0.1075	0.4555	16.8449	0.6688
4.54	0.2343	0.1066	0.4551	17.1317	0.6700
4.56	0.2326	0.1058	0.4547	17.4228	0.6712
4.58	0.2310	0.1049	0.4543	17.7181	0.6723
4.60	0.2294	0.1041	0.4539	18.0178	0.6734
-	-	-	-	-	-
4.62	0.2278	0.1033	0.4536	18.3218	0.6746
4.64	0.2262	0.1025	0.4532	18.6303	0.6757
4.66	0.2246	0.1017	0.4528	18.9433	0.6768
4.68	0.2230	0.1009	0.4525	19.2608	0.6779
4.70	0.2215	0.1001	0.4521	19.5828	0.6790
-	-	-	-	-	-
4.72	0.2200	0.0994	0.4517	19.9095	0.6800
4.74	0.2184	0.0986	0.4514	20.2409	0.6811
4.76	0.2169	0.0979	0.4510	20.5770	0.6821
4.78	0.2155	0.0971	0.4507	20.9179	0.6831
4.80	0.2140	0.0964	0.4504	21.2637	0.6842

Table E.1: Rayleigh flow properties for $\gamma = 1.4$

M	T/T^*	P/P^*	ρ/ρ^*	T_0/T_0^*	P_0/P_0^*
0.02	0.0023	2.3987	1042.2500	0.0019	1.2675
0.04	0.0092	2.3946	261.0000	0.0076	1.2665
0.06	0.0205	2.3880	116.3241	0.0171	1.2647
0.08	0.0362	2.3787	65.6875	0.0302	1.2623
0.10	0.0560	2.3669	42.2500	0.0468	1.2591
-	-	-	-	-	-
0.12	0.0797	2.3526	29.5185	0.0666	1.2554
0.14	0.1069	2.3359	21.8418	0.0895	1.2510
0.16	0.1374	2.3170	16.8594	0.1151	1.2461
0.18	0.1708	2.2959	13.4434	0.1432	1.2406
0.20	0.2066	2.2727	11.0000	0.1736	1.2346
-	-	-	-	-	-
0.22	0.2445	2.2477	9.1921	0.2057	1.2281
0.24	0.2841	2.2209	7.8171	0.2395	1.2213
0.26	0.3250	2.1925	6.7470	0.2745	1.2140
0.28	0.3667	2.1626	5.8980	0.3104	1.2064
0.30	0.4089	2.1314	5.2130	0.3469	1.1985
-	-	-	-	-	-
0.32	0.4512	2.0991	4.6523	0.3837	1.1904
0.34	0.4933	2.0657	4.1877	0.4206	1.1822
0.36	0.5348	2.0314	3.7984	0.4572	1.1737
0.38	0.5755	1.9964	3.4688	0.4935	1.1652
0.40	0.6151	1.9608	3.1875	0.5290	1.1566
-	-	-	-	-	-
0.42	0.6535	1.9247	2.9454	0.5638	1.1480
0.44	0.6903	1.8882	2.7355	0.5975	1.1394
0.46	0.7254	1.8515	2.5525	0.6301	1.1308
0.48	0.7587	1.8147	2.3918	0.6614	1.1224
0.50	0.7901	1.7778	2.2500	0.6914	1.1141
-	-	-	-	-	-
0.52	0.8196	1.7409	2.1243	0.7199	1.1059
0.54	0.8469	1.7043	2.0122	0.7470	1.0979
0.56	0.8723	1.6678	1.9120	0.7725	1.0901
0.58	0.8955	1.6316	1.8219	0.7965	1.0826
0.60	0.9167	1.5957	1.7407	0.8189	1.0753
-	-	-	-	-	-
0.62	0.9358	1.5603	1.6673	0.8398	1.0682
0.64	0.9530	1.5253	1.6006	0.8592	1.0615
0.66	0.9682	1.4908	1.5399	0.8771	1.0550
0.68	0.9814	1.4569	1.4844	0.8935	1.0489
0.70	0.9929	1.4235	1.4337	0.9085	1.0431
-	-	-	-	-	-
0.72	1.0026	1.3907	1.3871	0.9221	1.0376
0.74	1.0106	1.3585	1.3442	0.9344	1.0325
0.76	1.0171	1.3270	1.3047	0.9455	1.0278
0.78	1.0220	1.2961	1.2682	0.9553	1.0234
0.80	1.0255	1.2658	1.2344	0.9639	1.0193
0.82	1.0276	1.2362	1.2030	0.9715	1.0157
0.84	1.0285	1.2073	1.1738	0.9781	1.0124
0.86	1.0283	1.1791	1.1467	0.9836	1.0095
0.88	1.0269	1.1515	1.1214	0.9883	1.0070
0.90	1.0245	1.1246	1.0977	0.9921	1.0049
-	-	-	-	-	-
0.92	1.0212	1.0984	1.0756	0.9951	1.0031
0.94	1.0170	1.0728	1.0549	0.9973	1.0017
0.96	1.0121	1.0479	1.0354	0.9988	1.0008
0.98	1.0064	1.0236	1.0172	0.9997	1.0002
1.00	1.0000	1.0000	1.0000	1.0000	1.0000
-	-	-	-	-	-
1.02	0.9930	0.9770	0.9838	0.9997	1.0002
1.04	0.9855	0.9546	0.9686	0.9989	1.0008
1.06	0.9776	0.9327	0.9542	0.9977	1.0017
1.08	0.9691	0.9115	0.9406	0.9960	1.0031
1.10	0.9603	0.8909	0.9277	0.9939	1.0049
-	-	-	-	-	-
1.12	0.9512	0.8708	0.9155	0.9915	1.0070
1.14	0.9417	0.8512	0.9039	0.9887	1.0095
1.16	0.9320	0.8322	0.8930	0.9856	1.0124
1.18	0.9220	0.8137	0.8826	0.9823	1.0157
1.20	0.9118	0.7958	0.8727	0.9787	1.0194
-	-	-	-	-	-
1.22	0.9015	0.7783	0.8633	0.9749	1.0235
1.24	0.8911	0.7613	0.8543	0.9709	1.0279
1.26	0.8805	0.7447	0.8458	0.9668	1.0328
1.28	0.8699	0.7287	0.8376	0.9624	1.0380
1.30	0.8592	0.7130	0.8299	0.9580	1.0437
-	-	-	-	-	-
1.32	0.8484	0.6978	0.8225	0.9534	1.0497
1.34	0.8377	0.6830	0.8154	0.9487	1.0561
1.36	0.8269	0.6686	0.8086	0.9440	1.0629
1.38	0.8161	0.6546	0.8021	0.9391	1.0701
1.40	0.8054	0.6410	0.7959	0.9343	1.0777
-	-	-	-	-	-
1.42	0.7947	0.6278	0.7900	0.9293	1.0856
1.44	0.7840	0.6149	0.7843	0.9243	1.0940
1.46	0.7735	0.6024	0.7788	0.9193	1.1028
1.48	0.7629	0.5902	0.7736	0.9143	1.1120
1.50	0.7525	0.5783	0.7685	0.9093	1.1215
-	-	-	-	-	-
1.52	0.7422	0.5668	0.7637	0.9042	1.1315
1.54	0.7319	0.5555	0.7590	0.8992	1.1419
1.56	0.7217	0.5446	0.7545	0.8942	1.1527
1.58	0.7117	0.5339	0.7502	0.8892	1.1640
1.60	0.7017	0.5236	0.7461	0.8842	1.1756
1.62	0.6919	0.5135	0.7421	0.8792	1.1877
1.64	0.6822	0.5036	0.7383	0.8743	1.2002
1.66	0.6726	0.4940	0.7345	0.8694	1.2131
1.68	0.6631	0.4847	0.7310	0.8645	1.2264
1.70	0.6538	0.4756	0.7275	0.8597	1.2402
-	-	-	-	-	-
1.72	0.6445	0.4668	0.7242	0.8549	1.2545
1.74	0.6355	0.4581	0.7210	0.8502	1.2692
1.76	0.6265	0.4497	0.7178	0.8455	1.2843
1.78	0.6176	0.4415	0.7148	0.8409	1.2999
1.80	0.6089	0.4335	0.7119	0.8363	1.3159
-	-	-	-	-	-
1.82	0.6004	0.4257	0.7091	0.8317	1.3324
1.84	0.5919	0.4181	0.7064	0.8273	1.3494
1.86	0.5836	0.4107	0.7038	0.8228	1.3669
1.88	0.5754	0.4035	0.7012	0.8185	1.3849
1.90	0.5673	0.3964	0.6988	0.8141	1.4033
-	-	-	-	-	-
1.92	0.5594	0.3895	0.6964	0.8099	1.4222
1.94	0.5516	0.3828	0.6940	0.8057	1.4417
1.96	0.5439	0.3763	0.6918	0.8015	1.4616
1.98	0.5364	0.3699	0.6896	0.7974	1.4821
2.00	0.5289	0.3636	0.6875	0.7934	1.5031
-	-	-	-	-	-
2.02	0.5216	0.3575	0.6854	0.7894	1.5246
2.04	0.5144	0.3516	0.6835	0.7855	1.5467
2.06	0.5074	0.3458	0.6815	0.7816	1.5693
2.08	0.5004	0.3401	0.6796	0.7778	1.5924
2.10	0.4936	0.3345	0.6778	0.7741	1.6162
-	-	-	-	-	-
2.12	0.4868	0.3291	0.6760	0.7704	1.6404
2.14	0.4802	0.3238	0.6743	0.7667	1.6653
2.16	0.4737	0.3186	0.6726	0.7631	1.6908
2.18	0.4673	0.3136	0.6710	0.7596	1.7168
2.20	0.4611	0.3086	0.6694	0.7561	1.7434
-	-	-	-	-	-
2.22	0.4549	0.3038	0.6679	0.7527	1.7707
2.24	0.4488	0.2991	0.6664	0.7493	1.7986
2.26	0.4428	0.2945	0.6649	0.7460	1.8271
2.28	0.4370	0.2899	0.6635	0.7428	1.8562
2.30	0.4312	0.2855	0.6621	0.7395	1.8860
-	-	-	-	-	-
2.32	0.4256	0.2812	0.6607	0.7364	1.9165
2.34	0.4200	0.2769	0.6594	0.7333	1.9476
2.36	0.4145	0.2728	0.6581	0.7302	1.9794
2.38	0.4091	0.2688	0.6569	0.7272	2.0119
2.40	0.4038	0.2648	0.6557	0.7242	2.0451

Table E.2: Rayleigh flow properties for $\gamma = 1.4$

M	T/T^*	P/P^*	ρ/ρ^*	T_0/T_0^*	P_0/P_0^*
2.42	0.3986	0.2609	0.6545	0.7213	2.0789
2.44	0.3935	0.2571	0.6533	0.7184	2.1136
2.46	0.3885	0.2534	0.6522	0.7156	2.1489
2.48	0.3836	0.2497	0.6511	0.7128	2.1850
2.50	0.3787	0.2462	0.6500	0.7101	2.2218
-	-	-	-	-	-
2.52	0.3739	0.2427	0.6489	0.7074	2.2594
2.54	0.3692	0.2392	0.6479	0.7047	2.2978
2.56	0.3646	0.2359	0.6469	0.7021	2.3370
2.58	0.3601	0.2326	0.6459	0.6995	2.3770
2.60	0.3556	0.2294	0.6450	0.6970	2.4177
-	-	-	-	-	-
2.62	0.3512	0.2262	0.6440	0.6945	2.4593
2.64	0.3469	0.2231	0.6431	0.6921	2.5018
2.66	0.3427	0.2201	0.6422	0.6896	2.5451
2.68	0.3385	0.2171	0.6413	0.6873	2.5892
2.70	0.3344	0.2142	0.6405	0.6849	2.6343
-	-	-	-	-	-
2.72	0.3304	0.2113	0.6397	0.6826	2.6802
2.74	0.3264	0.2085	0.6388	0.6804	2.7270
2.76	0.3225	0.2058	0.6380	0.6781	2.7748
2.78	0.3186	0.2030	0.6372	0.6760	2.8235
2.80	0.3149	0.2004	0.6365	0.6738	2.8731
-	-	-	-	-	-
2.82	0.3111	0.1978	0.6357	0.6717	2.9237
2.84	0.3075	0.1953	0.6350	0.6696	2.9752
2.86	0.3039	0.1927	0.6343	0.6675	3.0278
2.88	0.3004	0.1903	0.6336	0.6655	3.0813
2.90	0.2969	0.1879	0.6329	0.6635	3.1359
-	-	-	-	-	-
2.92	0.2934	0.1855	0.6322	0.6615	3.1914
2.94	0.2901	0.1832	0.6315	0.6596	3.2481
2.96	0.2868	0.1809	0.6309	0.6577	3.3058
2.98	0.2835	0.1787	0.6303	0.6558	3.3646
3.00	0.2803	0.1765	0.6296	0.6540	3.4245
-	-	-	-	-	-
3.02	0.2771	0.1743	0.6290	0.6522	3.4854
3.04	0.2740	0.1722	0.6284	0.6504	3.5476
3.06	0.2709	0.1701	0.6278	0.6486	3.6108
3.08	0.2679	0.1681	0.6273	0.6469	3.6752
3.10	0.2650	0.1660	0.6267	0.6452	3.7408
-	-	-	-	-	-
3.12	0.2620	0.1641	0.6261	0.6435	3.8076
3.14	0.2592	0.1621	0.6256	0.6418	3.8756
3.16	0.2563	0.1602	0.6251	0.6402	3.9449
3.18	0.2535	0.1583	0.6245	0.6386	4.0154
3.20	0.2508	0.1565	0.6240	0.6370	4.0871

M	T/T^*	P/P^*	ρ/ρ^*	T_0/T_0^*	P_0/P_0^*
3.22	0.2481	0.1547	0.6235	0.6354	4.1602
3.24	0.2454	0.1529	0.6230	0.6339	4.2345
3.26	0.2428	0.1511	0.6225	0.6324	4.3101
3.28	0.2402	0.1494	0.6221	0.6309	4.3871
3.30	0.2377	0.1477	0.6216	0.6294	4.4655
-	-	-	-	-	-
3.32	0.2352	0.1461	0.6211	0.6280	4.5452
3.34	0.2327	0.1444	0.6207	0.6265	4.6263
3.36	0.2303	0.1428	0.6202	0.6251	4.7089
3.38	0.2279	0.1412	0.6198	0.6237	4.7929
3.40	0.2255	0.1397	0.6194	0.6224	4.8783
-	-	-	-	-	-
3.42	0.2232	0.1381	0.6190	0.6210	4.9652
3.44	0.2209	0.1366	0.6185	0.6197	5.0536
3.46	0.2186	0.1351	0.6181	0.6184	5.1435
3.48	0.2164	0.1337	0.6177	0.6171	5.2350
3.50	0.2142	0.1322	0.6173	0.6158	5.3280
-	-	-	-	-	-
3.52	0.2120	0.1308	0.6170	0.6145	5.4226
3.54	0.2099	0.1294	0.6166	0.6133	5.5188
3.56	0.2078	0.1280	0.6162	0.6121	5.6167
3.58	0.2057	0.1267	0.6158	0.6109	5.7162
3.60	0.2037	0.1254	0.6155	0.6097	5.8173
-	-	-	-	-	-
3.62	0.2017	0.1241	0.6151	0.6085	5.9201
3.64	0.1997	0.1228	0.6148	0.6074	6.0247
3.66	0.1977	0.1215	0.6144	0.6062	6.1310
3.68	0.1958	0.1202	0.6141	0.6051	6.2390
3.70	0.1939	0.1190	0.6138	0.6040	6.3488
-	-	-	-	-	-
3.72	0.1920	0.1178	0.6134	0.6029	6.4605
3.74	0.1902	0.1166	0.6131	0.6018	6.5739
3.76	0.1884	0.1154	0.6128	0.6008	6.6893
3.78	0.1866	0.1143	0.6125	0.5997	6.8065
3.80	0.1848	0.1131	0.6122	0.5987	6.9256
-	-	-	-	-	-
3.82	0.1830	0.1120	0.6119	0.5977	7.0466
3.84	0.1813	0.1109	0.6116	0.5967	7.1696
3.86	0.1796	0.1098	0.6113	0.5957	7.2945
3.88	0.1779	0.1087	0.6110	0.5947	7.4215
3.90	0.1763	0.1077	0.6107	0.5937	7.5505
-	-	-	-	-	-
3.92	0.1746	0.1066	0.6104	0.5928	7.6816
3.94	0.1730	0.1056	0.6102	0.5918	7.8147
3.96	0.1714	0.1046	0.6099	0.5909	7.9499
3.98	0.1699	0.1036	0.6096	0.5900	8.0873
4.00	0.1683	0.1026	0.6094	0.5891	8.2268

M	T/T^*	P/P^*	ρ/ρ^*	T_0/T_0^*	P_0/P_0^*
4.02	0.1668	0.1016	0.6091	0.5882	8.3686
4.04	0.1653	0.1006	0.6089	0.5873	8.5125
4.06	0.1638	0.0997	0.6086	0.5864	8.6587
4.08	0.1623	0.0987	0.6084	0.5856	8.8072
4.10	0.1609	0.0978	0.6081	0.5847	8.9579
-	-	-	-	-	-
4.12	0.1594	0.0969	0.6079	0.5839	9.1110
4.14	0.1580	0.0960	0.6076	0.5831	9.2665
4.16	0.1566	0.0951	0.6074	0.5823	9.4243
4.18	0.1552	0.0943	0.6072	0.5814	9.5846
4.20	0.1539	0.0934	0.6070	0.5807	9.7473
-	-	-	-	-	-
4.22	0.1525	0.0926	0.6067	0.5799	9.9125
4.24	0.1512	0.0917	0.6065	0.5791	10.0802
4.26	0.1499	0.0909	0.6063	0.5783	10.2504
4.28	0.1486	0.0901	0.6061	0.5776	10.4232
4.30	0.1473	0.0893	0.6059	0.5768	10.5985
-	-	-	-	-	-
4.32	0.1461	0.0885	0.6057	0.5761	10.7766
4.34	0.1448	0.0877	0.6055	0.5754	10.9572
4.36	0.1436	0.0869	0.6053	0.5746	11.1406
4.38	0.1424	0.0862	0.6051	0.5739	11.3267
4.40	0.1412	0.0854	0.6049	0.5732	11.5155
-	-	-	-	-	-
4.42	0.1400	0.0847	0.6047	0.5725	11.7072
4.44	0.1388	0.0839	0.6045	0.5718	11.9016
4.46	0.1377	0.0832	0.6043	0.5712	12.0989
4.48	0.1365	0.0825	0.6041	0.5705	12.2991
4.50	0.1354	0.0818	0.6039	0.5698	12.5023
-	-	-	-	-	-
4.52	0.1343	0.0811	0.6037	0.5692	12.7083
4.54	0.1332	0.0804	0.6035	0.5685	12.9174
4.56	0.1321	0.0797	0.6034	0.5679	13.1295
4.58	0.1310	0.0790	0.6032	0.5673	13.3446
4.60	0.1300	0.0784	0.6030	0.5666	13.5629
-	-	-	-	-	-
4.62	0.1289	0.0777	0.6029	0.5660	13.7843
4.64	0.1279	0.0771	0.6027	0.5654	14.0088
4.66	0.1268	0.0764	0.6025	0.5648	14.2365
4.68	0.1258	0.0758	0.6024	0.5642	14.4675
4.70	0.1248	0.0752	0.6022	0.5636	14.7017
-	-	-	-	-	-
4.72	0.1238	0.0746	0.6020	0.5630	14.9393
4.74	0.1229	0.0739	0.6019	0.5625	15.1802
4.76	0.1219	0.0733	0.6017	0.5619	15.4245
4.78	0.1209	0.0728	0.6016	0.5613	15.6722
4.80	0.1200	0.0722	0.6014	0.5608	15.9234