MEC8200 : Mécanique des fluides assisté par ordinateur

Devoir 1 - Équations de la couche limite et de Navier-Stokes

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A Données des coupe à $Re = 100$

TABLE 1 – Coupe en $X = 0.5$

Points	Ux	Vy	Pression
0.0	0.0	0.0	-0.104273007
0.00872981239	0.0793529312	-0.0137703102	-0.103435616
0.018332606	0.11821685	-0.0299171935	-0.093850035
0.028895679	0.162921741	-0.0297036553	-0.0858368619
0.0405150593	0.205740482	-0.0363522446	-0.0809837416
0.0532963776	0.254330726	-0.0345295998	-0.0765186051
0.0673558277	0.304265426	-0.0369649606	-0.072989592
0.0828212229	0.360619581	-0.034036508	-0.0694843197
0.0998331576	0.418665806	-0.0338219084	-0.0662689632
0.118546286	0.482975584	-0.0299768735	-0.0628619907
0.139130727	0.548085094	-0.0276953733	-0.0594444791
0.161773612	0.618001122	-0.0227951507	-0.0556656414
0.186680785	0.686243112	-0.0185391223	-0.0516696094
0.214078676	0.755793353	-0.0123401542	-0.0471505773
0.244216356	0.8189276	-0.00632227615	-0.0422367279
0.277367804	0.877649433	0.000760168364	-0.036657016
0.313834397	0.923903431	0.00730697059	-0.0305573358
0.353947649	0.960626729	0.0135397566	-0.0237173831
0.398072226	0.982320066	0.0183093529	-0.0163084308
0.446609261	0.995727223	0.0216448548	-0.00811315471
0.5	0.998222752	0.0236854229	-0.00411595636

TABLE 2 – Coupe en $X = 1.0$

Points	Ux	Vy	Pression
0.0	0.0	0.0	-0.0549115425
0.00872981239	0.0464252627	-0.00264179415	-0.0533211189
0.018332606	0.0975095622	0.00196275814	-0.0528256356
0.028895679	0.15319637	0.000110472473	-0.0523162679
0.0405150593	0.214483214	0.00555186346	-0.0516278767
0.0532963776	0.280602382	0.00576356579	-0.0509827034
0.0673558277	0.35270706	0.0128000824	-0.0501208095
0.0828212229	0.429124707	0.0160602927	-0.0492362853
0.0998331576	0.510540165	0.0255755223	-0.0480788137
0.118546286	0.593786048	0.0325780356	-0.0467647468
0.139130727	0.678358988	0.0449163284	-0.0450536953
0.161773612	0.758972896	0.0552391773	-0.0429889371
0.186680785	0.833895494	0.0690224865	-0.0403550728
0.214078676	0.896554783	0.0799730296	-0.0371835656
0.244216356	0.946319293	0.0914609791	-0.0333508058
0.277367804	0.978795502	0.0987320742	-0.0289592943
0.313834397	0.998097024	0.104344421	-0.0240034051
0.353947649	1.00391935	0.106124696	-0.0186242131
0.398072226	1.0038621	0.106591762	-0.012822288
0.446609261	0.998371455	0.105410119	-0.00664596813
0.5	0.996598573	0.103927805	-0.00359419258

Coupe en $Y = 0.05$

Points	Ux	Vy	Pression
-2.0	1.0	0.0	0.000562430539
-1.79763677	0.999845091	6.97324263e-05	0.000817737038
-1.6136702	0.999469641	0.000156356339	0.0012225013
-1.44642786	0.998689871	0.000283525655	0.0019522661
-1.29438937	0.997625191	0.00046359092	0.00308325522
-1.15617256	0.995916159	0.000727959954	0.00471598349
-1.03052092	0.9937584	0.00107673276	0.00695735297
-0.916292149	0.990662723	0.00155788395	0.00991535477
-0.812447815	0.98697935	0.00214932867	0.013683012
-0.718043875	0.982064886	0.00292834094	0.0183448591
-0.632222111	0.976506804	0.0038405547	0.0239613672
-0.554202325	0.969425376	0.005022458	0.0305924735
-0.483275248	0.961722865	0.00638179695	0.0382815221
-0.418796087	0.952129479	0.00817179183	0.0470953265
-0.360178667	0.941943164	0.0102655449	0.0571072017
-0.306890104	0.929277858	0.0131428059	0.0684395213
-0.258445956	0.915915881	0.0166765107	0.0812654404
-0.214405821	0.899060415	0.0218442934	0.0957965109
-0.174369335	0.881063296	0.028664378	0.112374384
-0.137972529	0.85783498	0.039571052	0.131170753
-0.104884524	0.832913046	0.0553476281	0.152282478
-0.0748045194	0.800041065	0.0838304044	0.174095801
-0.0474590607	0.775710056	0.133425935	0.18659973
-0.0225995527	0.766852459	0.188852103	0.174869
0.0	0.771238765	0.204167112	0.149231321
0.00966844026	0.761614307	0.195172336	0.109094514
0.0208850819	0.752698377	0.175877275	0.0811777861
0.0338978375	0.720718018	0.147683796	0.053845317
0.0489943177	0.685453347	0.120268078	0.0299003928
0.066508188	0.63580787	0.0933151159	0.0104106591
0.0868265436	0.589709071	0.0737501282	-0.00480568711
0.110398465	0.539428519	0.0556410318	-0.0166617055
0.137744944	0.49514636	0.0441507675	-0.0257663881
0.169470397	0.450998652	0.0327912934	-0.0328232732
0.206276028	0.412405176	0.0265457194	-0.0381963727
0.248975322	0.37548992	0.0192185505	-0.0423270458
0.298512028	0.343131256	0.0160915901	-0.0454137949
0.355981016	0.313071967	0.0109518957	-0.0477879241
0.422652478	0.286890535	0.00967574584	-0.049616071
0.5	0.263549858	0.0057089665	-0.0511490974

0.577347522	0.246555	0.00555759881	-0.0524811137
0.644018984	0.23543266	0.00273935373	-0.0539423976
0.701487972	0.228563348	0.00323708325	-0.0554367641
0.751024678	0.224040996	0.000982328649	-0.0571101646
0.793723972	0.221840184	0.00151408216	-0.0588402915
0.830529603	0.22059089	-0.000621815075	-0.0607017965
0.862255056	0.221102788	-0.00034034159	-0.0625847848
0.889601535	0.221921935	-0.00283346397	-0.0645795222
0.913173456	0.224508967	-0.00342589761	-0.0666060201
0.933491812	0.227054823	-0.00727862041	-0.0687811729
0.951005682	0.231355998	-0.0100985169	-0.0710344668
0.966102162	0.234681639	-0.0167452618	-0.0733825757
0.979114918	0.238626356	-0.0222963557	-0.0754501834
0.99033156	0.240150345	-0.0302281629	-0.0770168177
1.0	0.241799014	-0.0349996707	-0.0776701902
1.01002919	0.241731522	-0.0412999724	-0.077325912
1.0210613	0.242259914	-0.0440936505	-0.0755617815
1.03319662	0.242942339	-0.0466655639	-0.072500087
1.04654548	0.245499162	-0.0453225696	-0.068180385
1.06122922	0.250109609	-0.0438764324	-0.0632005449
1.07738133	0.256735922	-0.040542677	-0.0578975092
1.09514865	0.265093848	-0.0379781876	-0.0526171068
1.11469271	0.274606132	-0.0347347609	-0.0474319545
1.13619117	0.285255337	-0.0322727006	-0.0424149336
1.15983948	0.29660457	-0.0295789219	-0.0375736222
1.18585262	0.308762373	-0.0274869794	-0.0329187408
1.21446708	0.321451354	-0.0253226834	-0.0284537601
1.24594298	0.334802875	-0.0235931906	-0.0241846927
1.28056646	0.348648017	-0.0218435518	-0.0201237605
1.3186523	0.363101681	-0.0204061224	-0.016284867
1.36054672	0.378060391	-0.0189580468	-0.0126896382
1.40663059	0.393609355	-0.0177369251	-0.0093601138
1.45732284	0.409678072	-0.0164970056	-0.00632384745
1.51308431	0.426315316	-0.0154249427	-0.00360636049
1.57442194	0.443457177	-0.014319737	-0.00123450485
1.64189332	0.461108798	-0.01334185	0.000771009427
1.71611184	0.479190593	-0.0123172305	0.00239378004
1.79775222	0.497656653	-0.011394505	0.00362883303
1.88755663	0.516395949	-0.0104179119	0.00448124718
1.98634149	0.535309081	-0.00953169338	0.00497183721
2.09500483	0.55425078	-0.0085957413	0.00513434114
2.2145345	0.5730783	-0.00775042603	0.00501793472
2.34601714	0.591629035	-0.0068731179	0.00468115714

2.49064805	0.609743497	-0.00609233057	0.00419036596
2.64974205	0.627277143	-0.00530881738	0.00361054298
2.82474544	0.644088985	-0.00462253789	0.00300147989
3.01724918	0.660091638	-0.00396857569	0.00240863055
3.22900329	0.675187101	-0.00339607284	0.0018576809
3.46193281	0.689387207	-0.00290059966	0.00133846001
3.71815528	0.702694002	-0.0024607675	0.00087194953
4.0	0.714852191	-0.00198672436	0.000668441941

B Données des coupe à $Re = 10\,000$

TABLE 4 – Coupe en $X = 0.5$

Points	Ux	Vy	Pression
0.0	0.0	0.0	-0.0111047813
0.00872981239	0.371919544	-0.152768421	-0.010723657
0.018332606	0.695444497	-0.0697721587	-0.0111195365
0.028895679	0.971931543	-0.0987785	-0.00963862545
0.0405150593	0.991659885	0.0171687987	-0.00888528891
0.0532963776	1.01668245	-0.020033704	-0.00855286568
0.0673558277	1.00767027	0.0340559743	-0.00831858128
0.0828212229	1.00726561	-0.0110262566	-0.00804126734
0.0998331576	1.01150493	0.0293722133	-0.00768267759
0.118546286	1.00234132	-0.00389263319	-0.00729667398
0.139130727	1.01316749	0.0234999483	-0.0068459793
0.161773612	0.999443448	0.00126660601	-0.00636738487
0.186680785	1.01399148	0.0186491514	-0.00583210361
0.214078676	0.996575835	0.00478288273	-0.00526502879
0.244216356	1.01464682	0.0149931504	-0.00464580285
0.277367804	0.993205153	0.007020143	-0.00399135503
0.313834397	1.01559909	0.0123922434	-0.00328613569
0.353947649	0.989199653	0.00833385304	-0.00254072909
0.398072226	1.01641084	0.0106941066	-0.0017393905
0.446609261	0.986209694	0.00901582367	-0.000884091484
0.5	1.01207041	0.00998949588	-0.000459299998

TABLE 5 – Coupe en $X = 1.0$

Points	Ux	Vy	Pression
0.0	0.0	0.0	-0.0229987194
0.00872981239	0.291089793	0.120070903	-0.0259807228
0.018332606	0.633038959	-0.0472205391	-0.0252629499
0.028895679	0.847073263	0.0234063115	-0.02188209
0.0405150593	0.988449771	-0.0226506905	-0.0192959628
0.0532963776	1.01289439	0.00753902382	-0.0166938878
0.0673558277	1.01760026	-0.0152506344	-0.0146407361
0.0828212229	1.01456059	0.00278800793	-0.0128692647
0.0998331576	1.01179157	-0.0110336302	-0.0114087354
0.118546286	1.01214206	0.000675932923	-0.0101011533
0.139130727	1.00769318	-0.00788391027	-0.00897287792
0.161773612	1.01029217	-0.000315400814	-0.00791416353
0.186680785	1.00517737	-0.00543423658	-0.00697239183
0.214078676	1.00827867	-0.000691416346	-0.00604849848
0.244216356	1.00377854	-0.00354071366	-0.00520316513
0.277367804	1.00560134	-0.000733307252	-0.00434029283
0.313834397	1.00347545	-0.00212688339	-0.00352668589
0.353947649	1.00203816	-0.000638755844	-0.00266613719
0.398072226	1.00367604	-0.00117149665	-0.00182504014
0.446609261	0.999277784	-0.000570109055	-0.000904131947
0.5	0.998944401	-0.000769328627	-0.000486150916

Coupe en $Y = 0.05$

Points	Ux	Vy	Pression
-2.0	1.0	0.0	0.000308635662
-1.79763677	0.997361089	-0.000398843371	0.000208134785
-1.6136702	1.00415898	0.000938961701	0.000186088936
-1.44642786	0.996271486	-0.00112327077	0.000344328638
-1.29438937	1.00633782	0.00173043066	0.00044606246
-1.15617256	0.994254777	-0.00155948424	0.000682736079
-1.03052092	1.0080704	0.00226197921	0.000943464075
-0.916292149	0.991478395	-0.0015741017	0.0013049062
-0.812447815	1.00962723	0.00257186524	0.00174919785
-0.718043875	0.987935391	-0.00119367006	0.00226992093
-0.632222111	1.01102273	0.00282744798	0.00289975233
-0.554202325	0.983754638	-0.00056545732	0.00359224781
-0.483275248	1.0121285	0.00324118526	0.00439798969
-0.418796087	0.979162594	8.20963475e-05	0.00527428195
-0.360178667	1.01268033	0.00399400694	0.00628231359
-0.306890104	0.974312226	0.000496895379	0.00742198058
-0.258445956	1.01219335	0.00525646197	0.00878631272
-0.214405821	0.969025191	0.000595594488	0.0104387194
-0.174369335	1.00982963	0.00750740932	0.0125317124
-0.137972529	0.962575346	0.00107630764	0.0151337959
-0.104884524	1.00458565	0.0126484207	0.0183490729
-0.0748045194	0.954250622	0.0050084681	0.0217873753
-0.0474590607	0.997866025	0.0278977723	0.0232208102
-0.0225995527	0.95546596	0.0198347861	0.0199331637
0.0	1.00930982	0.0465636597	0.0146688281
0.00966844026	0.972273992	0.0191884749	0.00776246274
0.0208850819	1.01105878	0.0534242737	0.0037094413
0.0338978375	0.98745353	0.0115110256	0.000480709736
0.0489943177	1.01102177	0.0500612812	-0.00151825475
0.066508188	0.99592902	0.00557278876	-0.00261396894
0.0868265436	1.00870546	0.045038617	-0.00326167204
0.110398465	1.00020938	0.00262659131	-0.00370065184
0.137744944	1.00627899	0.0411633422	-0.00424174994
0.169470397	1.00385554	0.00171240636	-0.00490443624
0.206276028	1.0044366	0.0359200164	-0.00503027316
0.248975322	1.00538074	0.00347112929	-0.0063735371
0.298512028	1.0075225	0.0297152065	-0.00616463501
0.355981016	1.00172021	0.00206913528	-0.00665904839
0.422652478	1.01359036	0.0333321151	-0.0101729695
0.5	1.01022899	-0.0104389585	-0.0086385996

0.577347522	1.00077173	0.0296487073	-0.0079139131
0.644018984	1.01801394	-0.00202678704	-0.0117976366
0.701487972	1.00355009	0.0148198625	-0.0115288734
0.751024678	1.00953233	-0.00229367225	-0.0110314556
0.793723972	1.00574401	0.0127119433	-0.0117196548
0.830529603	1.00599132	-0.00540443081	-0.011606968
0.862255056	1.00535015	0.0118289652	-0.0121726952
0.889601535	1.00528373	-0.00701779383	-0.0125698451
0.913173456	1.00498769	0.00978867403	-0.013137754
0.933491812	1.00527165	-0.00762400304	-0.0137699369
0.951005682	1.00543626	0.00720910128	-0.0144498066
0.966102162	1.00580067	-0.00826597982	-0.0152086213
0.979114918	1.00632218	0.00429434874	-0.0160668884
0.99033156	1.00728262	-0.00952273497	-0.0168318583
1.0	1.00658998	-0.000247082078	-0.0173649783
1.01002919	1.00798626	-0.0112896355	-0.0173837871
1.0210613	1.00537018	-0.00633675967	-0.0166203608
1.03319662	1.00571067	-0.0141312068	-0.0150530547
1.04654548	1.0015929	-0.011395206	-0.0128392353
1.06122922	1.00076326	-0.0154592224	-0.0104146418
1.07738133	0.996975552	-0.0130551032	-0.00809391309
1.09514865	0.99614234	-0.0146985296	-0.00601945448
1.11469271	0.993300022	-0.012615732	-0.00421118928
1.13619117	0.992603852	-0.0130993261	-0.00265726535
1.15983948	0.990514731	-0.0112618833	-0.00134895517
1.18585262	0.989970648	-0.011173699	-0.000267521807
1.21446708	0.988436351	-0.00954179355	0.000599694712
1.24594298	0.988018685	-0.00920723807	0.00127356565
1.28056646	0.986858956	-0.00778251447	0.00177235677
1.3186523	0.986497895	-0.00739097901	0.00211888451
1.36054672	0.985541339	-0.00617775265	0.00233374744
1.40663059	0.985139915	-0.00582816427	0.00243842695
1.45732284	0.984225513	-0.00481570074	0.00245186438
1.51308431	0.983674365	-0.00454747841	0.00239192769
1.57442194	0.982650087	-0.00371154318	0.00227426909
1.64189332	0.981832699	-0.003530624	0.00211313403
1.71611184	0.98055253	-0.00284181118	0.00192135671
1.79775222	0.979350243	-0.00273975445	0.00171059689
1.88755663	0.977680145	-0.00217023383	0.00149160857
1.98634149	0.975988172	-0.00213511399	0.00127378964
2.09500483	0.973827299	-0.00166096828	0.00106553536
2.2145345	0.971582597	-0.00168164707	0.000873104911
2.34601714	0.968893555	-0.00128179273	0.00070154527

2.49064805	0.966103244	-0.00134893138	0.000553015342
2.64974205	0.962936474	-0.00100280333	0.000428703225
2.82474544	0.959691512	-0.0011099298	0.000327074293
3.01724918	0.956190452	-0.000795586467	0.000245705304
3.22900329	0.952655898	-0.000941527182	0.000181119516
3.46193281	0.949042424	-0.000635411884	0.00012605376
3.71815528	0.945431942	-0.000827324891	7.25801824e-05
4.0	0.942007833	-0.000511250955	4.57629841e-05