**Kevin Moore**

**ME 541**

**March 10, 2018**

**HW5 Diffusion Schemes**

1. **Tabulated Values**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **x** | **V\_1.0m/s\_central** | **V\_1.0m/s\_upwind** | **V\_1.0m/s\_hybrid** | **V\_1.0m/s\_power** |
| 0 | 1 | 1 | 1 | 1 |
| 0.001 | 0.950473574 | 0.950473338 | 0.950473574 | 0.950473574 |
| 0.002 | 0.900897597 | 0.90089715 | 0.900897597 | 0.900897597 |
| 0.003 | 0.85127202 | 0.851271386 | 0.85127202 | 0.85127202 |
| 0.004 | 0.801596792 | 0.801595995 | 0.801596792 | 0.801596791 |
| 0.005 | 0.751871863 | 0.75187093 | 0.751871863 | 0.751871863 |
| 0.006 | 0.702097186 | 0.702096139 | 0.702097186 | 0.702097185 |
| 0.007 | 0.652272708 | 0.652271573 | 0.652272708 | 0.652272708 |
| 0.008 | 0.602398381 | 0.602397183 | 0.602398381 | 0.602398381 |
| 0.009 | 0.552474155 | 0.552472919 | 0.552474155 | 0.552474155 |
| 0.01 | 0.502499979 | 0.50249873 | 0.502499979 | 0.502499979 |
| 0.011 | 0.452475805 | 0.452474567 | 0.452475805 | 0.452475805 |
| 0.012 | 0.402401581 | 0.40240038 | 0.402401581 | 0.402401581 |
| 0.013 | 0.352277258 | 0.352276119 | 0.352277258 | 0.352277258 |
| 0.014 | 0.302102785 | 0.302101733 | 0.302102785 | 0.302102785 |
| 0.015 | 0.251878113 | 0.251877173 | 0.251878113 | 0.251878113 |
| 0.016 | 0.201603192 | 0.201602389 | 0.201603192 | 0.201603191 |
| 0.017 | 0.15127797 | 0.15127733 | 0.15127797 | 0.15127797 |
| 0.018 | 0.100902397 | 0.100901945 | 0.100902397 | 0.100902397 |
| 0.019 | 0.050476424 | 0.050476185 | 0.050476424 | 0.050476424 |
| 0.02 | 0 | 0 | 0 | 0 |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **x** | **V\_20.0m/s\_central** | **V\_20.0m/s\_upwind** | **V\_20.0m/s\_hybrid** | **V\_20.0m/s\_power** |
| 0 | 1 | 1 | 1 | 1 |
| 0.001 | 0.958926009 | 0.958843282 | 0.958926009 | 0.958925676 |
| 0.002 | 0.917022241 | 0.916863429 | 0.917022241 | 0.917021601 |
| 0.003 | 0.874271931 | 0.87404398 | 0.874271931 | 0.874271013 |
| 0.004 | 0.83065798 | 0.830368141 | 0.83065798 | 0.830656812 |
| 0.005 | 0.786162938 | 0.785818786 | 0.786162938 | 0.786161551 |
| 0.006 | 0.740769006 | 0.740378444 | 0.740769006 | 0.740767432 |
| 0.007 | 0.694458026 | 0.694029294 | 0.694458026 | 0.694456298 |
| 0.008 | 0.64721147 | 0.646753162 | 0.64721147 | 0.647209622 |
| 0.009 | 0.599010438 | 0.598531507 | 0.599010438 | 0.599008507 |
| 0.01 | 0.549835648 | 0.549345419 | 0.549835648 | 0.549833671 |
| 0.011 | 0.499667427 | 0.49917561 | 0.499667427 | 0.499665444 |
| 0.012 | 0.448485708 | 0.448002404 | 0.448485708 | 0.448483759 |
| 0.013 | 0.396270014 | 0.395805734 | 0.396270014 | 0.396268142 |
| 0.014 | 0.342999458 | 0.34256513 | 0.342999458 | 0.342997706 |
| 0.015 | 0.288652729 | 0.288259715 | 0.288652729 | 0.288651144 |
| 0.016 | 0.233208086 | 0.232868191 | 0.233208086 | 0.233206715 |
| 0.017 | 0.176643349 | 0.176368836 | 0.176643349 | 0.176642242 |
| 0.018 | 0.118935891 | 0.118739495 | 0.118935891 | 0.118935098 |
| 0.019 | 0.060062625 | 0.059957567 | 0.060062625 | 0.060062201 |
| 0.02 | 0 | 0 | 0 | 0 |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **x** | **V\_75.0m/s\_central** | **V\_75.0m/s\_upwind** | **V\_75.0m/s\_hybrid** | **V\_75.0m/s\_power** |
| 0 | 1 | 1 | 1 | 1 |
| 0.001 | 0.977639723 | 0.976907808 | 0.977639723 | 0.977628564 |
| 0.002 | 0.953537087 | 0.952083702 | 0.953537087 | 0.95351491 |
| 0.003 | 0.927556323 | 0.925397788 | 0.927556323 | 0.927523359 |
| 0.004 | 0.899551084 | 0.896710431 | 0.899551084 | 0.899507667 |
| 0.005 | 0.869363619 | 0.865871522 | 0.869363619 | 0.869310199 |
| 0.006 | 0.836823883 | 0.832719694 | 0.836823883 | 0.836761046 |
| 0.007 | 0.801748584 | 0.79708148 | 0.801748584 | 0.801677066 |
| 0.008 | 0.763940145 | 0.758770399 | 0.763940145 | 0.763860854 |
| 0.009 | 0.723185594 | 0.717585987 | 0.723185594 | 0.723099632 |
| 0.01 | 0.679255363 | 0.673312745 | 0.679255363 | 0.679164052 |
| 0.011 | 0.631901997 | 0.625719009 | 0.631901997 | 0.631806906 |
| 0.012 | 0.580858759 | 0.574555743 | 0.580858759 | 0.580761731 |
| 0.013 | 0.525838125 | 0.519555232 | 0.525838125 | 0.525741316 |
| 0.014 | 0.46653017 | 0.460429683 | 0.46653017 | 0.466436082 |
| 0.015 | 0.402600815 | 0.396869717 | 0.402600815 | 0.402512339 |
| 0.016 | 0.333689952 | 0.328542754 | 0.333689952 | 0.333610413 |
| 0.017 | 0.259409412 | 0.255091269 | 0.259409412 | 0.259342619 |
| 0.018 | 0.179340777 | 0.176130923 | 0.179340777 | 0.179291078 |
| 0.019 | 0.093033028 | 0.09124855 | 0.093033028 | 0.093005371 |
| 0.02 | 0 | 0 | 0 | 0 |

1. **Plots**







1. **Error**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **1 m/s** | **Central**  2.77077e-9, | **Upwind**  1.66136e-5, | **Hybrid**  2.77077e-9, | **Power**  5.53824e-10, |
| **20 m/s** | 2.19913e-5, | 0.00651085, | 2.19913e-5, | 4.34554e-6, |
| **75 m/s** | 0.00104885, | 0.0801712, | 0.00104885, | 0.000200383 |

**Code can be found at: https://github.com/moore54/ME541.git**