**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 |
| 0.05 | 0.970164878 | 0.969757413 | 0.970164878 | 0.970160744 |
| 0.1 | 0.938799751 | 0.938002696 | 0.938799751 | 0.938791661 |
| 0.15 | 0.905826155 | 0.904660244 | 0.905826155 | 0.905814317 |
| 0.2 | 0.871161605 | 0.869650669 | 0.871161605 | 0.871146258 |
| 0.25 | 0.834719386 | 0.832890615 | 0.834719386 | 0.834700804 |
| 0.3 | 0.796408336 | 0.794292559 | 0.796408336 | 0.796386828 |
| 0.35 | 0.756132616 | 0.753764599 | 0.756132616 | 0.756108535 |
| 0.4 | 0.713791475 | 0.711210242 | 0.713791475 | 0.713765215 |
| 0.45 | 0.669278993 | 0.666528167 | 0.669278993 | 0.669250997 |
| 0.5 | 0.62248382 | 0.619611988 | 0.62248382 | 0.62245458 |
| 0.55 | 0.573288894 | 0.570350001 | 0.573288894 | 0.573258959 |
| 0.6 | 0.521571151 | 0.518624913 | 0.521571151 | 0.52154113 |
| 0.65 | 0.467201217 | 0.464313572 | 0.467201217 | 0.46717178 |
| 0.7 | 0.410043081 | 0.407286663 | 0.410043081 | 0.41001497 |
| 0.75 | 0.349953758 | 0.347408409 | 0.349953758 | 0.349927789 |
| 0.8 | 0.286782932 | 0.284536243 | 0.286782932 | 0.28676 |
| 0.85 | 0.220372576 | 0.218520467 | 0.220372576 | 0.220353664 |
| 0.9 | 0.150556561 | 0.149203904 | 0.150556561 | 0.150542743 |
| 0.95 | 0.077160238 | 0.076421512 | 0.077160238 | 0.077152688 |
| 1 | 0 | 0 | 0 | 0 |

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| --- | --- | --- | --- | --- |
| **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 |
| 0.05 | 0.999999999 | 0.999999046 | 0.999999999 | 0.999999996 |
| 0.1 | 0.999999998 | 0.999997139 | 0.999999998 | 0.999999985 |
| 0.15 | 0.999999993 | 0.999993324 | 0.999999993 | 0.999999954 |
| 0.2 | 0.999999977 | 0.999985695 | 0.999999977 | 0.999999872 |
| 0.25 | 0.999999931 | 0.999970436 | 0.999999931 | 0.999999652 |
| 0.3 | 0.999999791 | 0.999939918 | 0.999999791 | 0.999999057 |
| 0.35 | 0.999999373 | 0.999878883 | 0.999999373 | 0.999997456 |
| 0.4 | 0.999998119 | 0.999756813 | 0.999998119 | 0.999993145 |
| 0.45 | 0.999994355 | 0.999512672 | 0.999994355 | 0.999981531 |
| 0.5 | 0.999983065 | 0.99902439 | 0.999983065 | 0.99995025 |
| 0.55 | 0.999949195 | 0.998047827 | 0.999949195 | 0.999865993 |
| 0.6 | 0.999847584 | 0.9960947 | 0.999847584 | 0.999639048 |
| 0.65 | 0.999542753 | 0.992188446 | 0.999542753 | 0.999027768 |
| 0.7 | 0.998628258 | 0.984375939 | 0.998628258 | 0.997381279 |
| 0.75 | 0.995884774 | 0.968750924 | 0.995884774 | 0.992946448 |
| 0.8 | 0.987654321 | 0.937500894 | 0.987654321 | 0.981001192 |
| 0.85 | 0.962962963 | 0.875000834 | 0.962962963 | 0.948826539 |
| 0.9 | 0.888888889 | 0.750000715 | 0.888888889 | 0.862163828 |
| 0.95 | 0.666666667 | 0.500000477 | 0.666666667 | 0.628737057 |
| 1 | 0 | 0 | 0 | 0 |

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| --- | --- | --- | --- | --- |
| **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 |
| 0.05 | 1 | 1 | 1 | 1 |
| 0.1 | 1 | 1 | 1 | 1 |
| 0.15 | 1.000000002 | 1 | 1 | 1 |
| 0.2 | 0.999999995 | 1 | 1 | 1 |
| 0.25 | 1.000000018 | 1 | 1 | 1 |
| 0.3 | 0.999999942 | 1 | 1 | 1 |
| 0.35 | 1.000000192 | 0.999999998 | 1 | 1 |
| 0.4 | 0.999999368 | 0.999999992 | 1 | 1 |
| 0.45 | 1.000002075 | 0.999999964 | 1 | 1 |
| 0.5 | 0.999993181 | 0.999999829 | 1 | 1 |
| 0.55 | 1.000022404 | 0.999999188 | 1 | 1 |
| 0.6 | 0.999926386 | 0.999996141 | 1 | 1 |
| 0.65 | 1.000241875 | 0.999981671 | 1 | 1 |
| 0.7 | 0.999205267 | 0.999912936 | 1 | 1 |
| 0.75 | 1.002611265 | 0.999586446 | 1 | 0.999999991 |
| 0.8 | 0.991420128 | 0.99803562 | 1 | 0.999999622 |
| 0.85 | 1.028191009 | 0.990669194 | 1 | 0.999984746 |
| 0.9 | 0.907372401 | 0.95567867 | 1 | 0.99938493 |
| 0.95 | 1.304347826 | 0.789473684 | 1 | 0.975199397 |
| 1 | 0 | 0 | 0 | 0 |

1. **Plots**

HW3_2_grid_conv_1.0.pdfHW3_2_grid_conv_20.0.pdfHW3_2_grid_conv_75.0.pdf

1. **Error**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **Central** | **Upwind** | **Hybrid** | **Power** |
| **1 m/s** | 2.77077e-9, | 1.66136e-5, | 2.77077e-9, | 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**](https://github.com/moore54/ME541.git)

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