CFD HW2 单精度与双精度计算结果

**单精度**

**1st-order Accurate Central Difference for ∂u/∂x**

**No1: Numerial=0.9999998838, Exact=1.0, TE\_t=-3e-13, TE\_round=6e-02, TE\_abs=1e-07, dx=1e-06, k=1**

**No2: Numerial=1.9999997676, Exact=2.0, TE\_t=3e-13, TE\_round=6e-02, TE\_abs=2e-07, dx=1e-06, k=2**

**No3: Numerial=0.9999999747, Exact=1.0, TE\_t=-3e-11, TE\_round=6e-03, TE\_abs=3e-08, dx=1e-05, k=1**

**No4: Numerial=1.9999999495, Exact=2.0, TE\_t=3e-11, TE\_round=6e-03, TE\_abs=5e-08, dx=1e-05, k=2**

**No5: Numerial=0.9999999747, Exact=1.0, TE\_t=-3e-09, TE\_round=6e-04, TE\_abs=3e-08, dx=1e-04, k=1**

**No6: Numerial=1.9999999495, Exact=2.0, TE\_t=3e-09, TE\_round=6e-04, TE\_abs=5e-08, dx=1e-04, k=2**

**No7: Numerial=1.0000003967, Exact=1.0, TE\_t=-3e-07, TE\_round=6e-05, TE\_abs=-4e-07, dx=1e-03, k=1**

**No8: Numerial=1.9999996293, Exact=2.0, TE\_t=3e-07, TE\_round=6e-05, TE\_abs=4e-07, dx=1e-03, k=2**

**No9: Numerial=1.0000333190, Exact=1.0, TE\_t=-3e-05, TE\_round=6e-06, TE\_abs=-3e-05, dx=1e-02, k=1**

**No10: Numerial=1.9999666139, Exact=2.0, TE\_t=3e-05, TE\_round=6e-06, TE\_abs=3e-05, dx=1e-02, k=2**

**No11: Numerial=1.0033300519, Exact=1.0, TE\_t=-3e-03, TE\_round=6e-07, TE\_abs=-3e-03, dx=1e-01, k=1**

**No12: Numerial=1.9966351986, Exact=2.0, TE\_t=3e-03, TE\_round=6e-07, TE\_abs=3e-03, dx=1e-01, k=2**

**2nd-order Accurate Central Difference for ∂u/∂x**

**No1: Numerial=0.999999883788404986262321472168, Exact=1.0, TE\_t=3e-03, TE\_r=2e-01, TE\_abs=1e-07, dx=1e-06, k=1**

**No2: Numerial=1.999999767576809972524642944336, Exact=2.0, TE\_t=3e-03, TE\_r=2e-01, TE\_abs=2e-07, dx=1e-06, k=2**

**No3: Numerial=0.999999974737875052532842801156, Exact=1.0, TE\_t=3e-03, TE\_r=2e-02, TE\_abs=3e-08, dx=1e-05, k=1**

**No4: Numerial=1.999999949475750105065685602312, Exact=2.0, TE\_t=3e-03, TE\_r=2e-02, TE\_abs=5e-08, dx=1e-05, k=2**

**No5: Numerial=1.000000047497451305389404296875, Exact=1.0, TE\_t=3e-03, TE\_r=2e-03, TE\_abs=-5e-08, dx=1e-04, k=1**

**No6: Numerial=2.000000094994902610778808593750, Exact=2.0, TE\_t=3e-03, TE\_r=2e-03, TE\_abs=-9e-08, dx=1e-04, k=2**

**No7: Numerial=1.000000008692343955729597837490, Exact=1.0, TE\_t=3e-03, TE\_r=2e-04, TE\_abs=-9e-09, dx=1e-03, k=1**

**No8: Numerial=2.000000017384687911459195674979, Exact=2.0, TE\_t=3e-03, TE\_r=2e-04, TE\_abs=-2e-08, dx=1e-03, k=2**

**No9: Numerial=1.000000039736429924275284975010, Exact=1.0, TE\_t=3e-03, TE\_r=2e-05, TE\_abs=-4e-08, dx=1e-02, k=1**

**No10: Numerial=2.000000079472859848550569950021, Exact=2.0, TE\_t=3e-03, TE\_r=2e-05, TE\_abs=-8e-08, dx=1e-02, k=2**

**No11: Numerial=1.000013450781504165121305049979, Exact=1.0, TE\_t=3e-03, TE\_r=2e-06, TE\_abs=-1e-05, dx=1e-01, k=1**

**No12: Numerial=2.000125646591186079348290149937, Exact=2.0, TE\_t=3e-03, TE\_r=2e-06, TE\_abs=-1e-04, dx=1e-01, k=2**

**2nd-order Accurate Central Difference for ∂2u/∂x2**

**No1: Numerial=-1.932676241267472505569458007812, Exact=-2.0, TE\_t=0e+00, TE\_r=5e+05, TE\_abs=-7e-02, dx=1e-06, k=1**

**No2: Numerial=-3.865352482534945011138916015625, Exact=-4.0, TE\_t=2e-12, TE\_r=5e+05, TE\_abs=-1e-01, dx=1e-06, k=2**

**No3: Numerial=-2.000888343900441679323876087437, Exact=-2.0, TE\_t=0e+00, TE\_r=5e+03, TE\_abs=9e-04, dx=1e-05, k=1**

**No4: Numerial=-4.001776687800883358647752174875, Exact=-4.0, TE\_t=2e-10, TE\_r=5e+03, TE\_abs=2e-03, dx=1e-05, k=2**

**No5: Numerial=-2.000888343900442123413085937500, Exact=-2.0, TE\_t=0e+00, TE\_r=5e+01, TE\_abs=9e-04, dx=1e-04, k=1**

**No6: Numerial=-4.001776687800884246826171875000, Exact=-4.0, TE\_t=2e-08, TE\_r=5e+01, TE\_abs=2e-03, dx=1e-04, k=2**

**No7: Numerial=-2.000015228986740112304687500000, Exact=-2.0, TE\_t=0e+00, TE\_r=5e-01, TE\_abs=2e-05, dx=1e-03, k=1**

**No8: Numerial=-4.000030457973480224609375000000, Exact=-4.0, TE\_t=2e-06, TE\_r=5e-01, TE\_abs=3e-05, dx=1e-03, k=2**

**No9: Numerial=-1.999996602535247802734375000000, Exact=-2.0, TE\_t=0e+00, TE\_r=5e-03, TE\_abs=-3e-06, dx=1e-02, k=1**

**No10: Numerial=-3.999806940555572509765625000000, Exact=-4.0, TE\_t=2e-04, TE\_r=5e-03, TE\_abs=-2e-04, dx=1e-02, k=2**

**No11: Numerial=-1.999998092651366743410790149937, Exact=-2.0, TE\_t=0e+00, TE\_r=5e-05, TE\_abs=-2e-06, dx=1e-01, k=1**

**No12: Numerial=-3.980012238025664395024705299875, Exact=-4.0, TE\_t=2e-02, TE\_r=5e-05, TE\_abs=-2e-02, dx=1e-01, k=2**

**1st-order Accurate Forward Difference for ∂2u/∂x2**

**No1: Numerial=-2.046363078989088535308837890625, Exact=-2.0, TE\_t=2e-06, TE\_r=5e+05, TE\_abs=5e-02, dx=1e-06, k=1**

**No2: Numerial=-4.092726157978177070617675781250, Exact=-4.0, TE\_t=-2e-06, TE\_r=5e+05, TE\_abs=9e-02, dx=1e-06, k=2**

**No3: Numerial=-2.000888343900441679323876087437, Exact=-2.0, TE\_t=2e-05, TE\_r=5e+03, TE\_abs=9e-04, dx=1e-05, k=1**

**No4: Numerial=-4.001776687800883358647752174875, Exact=-4.0, TE\_t=-2e-05, TE\_r=5e+03, TE\_abs=2e-03, dx=1e-05, k=2**

**No5: Numerial=-1.997977960854768753051757812500, Exact=-2.0, TE\_t=2e-04, TE\_r=5e+01, TE\_abs=-2e-03, dx=1e-04, k=1**

**No6: Numerial=-3.995955921709537506103515625000, Exact=-4.0, TE\_t=-2e-04, TE\_r=5e+01, TE\_abs=-4e-03, dx=1e-04, k=2**

**No7: Numerial=-1.998152583837509155273437500000, Exact=-2.0, TE\_t=2e-03, TE\_r=5e-01, TE\_abs=-2e-03, dx=1e-03, k=1**

**No8: Numerial=-4.001893103122711181640625000000, Exact=-4.0, TE\_t=-2e-03, TE\_r=5e-01, TE\_abs=2e-03, dx=1e-03, k=2**

**No9: Numerial=-1.980010420083999633789062500000, Exact=-2.0, TE\_t=2e-02, TE\_r=5e-03, TE\_abs=-2e-02, dx=1e-02, k=1**

**No10: Numerial=-4.018582403659820556640625000000, Exact=-4.0, TE\_t=-2e-02, TE\_r=5e-03, TE\_abs=2e-02, dx=1e-02, k=2**

**No11: Numerial=-1.800933480262755903567040149937, Exact=-2.0, TE\_t=2e-01, TE\_r=5e-05, TE\_abs=-2e-01, dx=1e-01, k=1**

**No12: Numerial=-4.069814085960387295415330299875, Exact=-4.0, TE\_t=-2e-01, TE\_r=5e-05, TE\_abs=7e-02, dx=1e-01, k=2**

**双精度**

**1st-order Accurate Central Difference for ∂u/∂x**

**No1: Numerial=1.000000000000333288951992471993, Exact=1.0, TE\_t=-3e-13, TE\_round=5e-11, TE\_abs=-3e-13, dx=1e-06, k=1**

**No2: Numerial=1.999999999999666711048007528007, Exact=2.0, TE\_t=3e-13, TE\_round=5e-11, TE\_abs=3e-13, dx=1e-06, k=2**

**No3: Numerial=1.000000000033333336091345699970, Exact=1.0, TE\_t=-3e-11, TE\_round=5e-12, TE\_abs=-3e-11, dx=1e-05, k=1**

**No4: Numerial=1.999999999966666441864049374999, Exact=2.0, TE\_t=3e-11, TE\_round=5e-12, TE\_abs=3e-11, dx=1e-05, k=2**

**No5: Numerial=1.000000003333333387089965071937, Exact=1.0, TE\_t=-3e-09, TE\_round=5e-13, TE\_abs=-3e-09, dx=1e-04, k=1**

**No6: Numerial=1.999999996666666834954639853095, Exact=2.0, TE\_t=3e-09, TE\_round=5e-13, TE\_abs=3e-09, dx=1e-04, k=2**

**No7: Numerial=1.000000333333300295279855163244, Exact=1.0, TE\_t=-3e-07, TE\_round=5e-14, TE\_abs=-3e-07, dx=1e-03, k=1**

**No8: Numerial=1.999999666666350206511992837477, Exact=2.0, TE\_t=3e-07, TE\_round=5e-14, TE\_abs=3e-07, dx=1e-03, k=2**

**No9: Numerial=1.000033332999998414436504390324, Exact=1.0, TE\_t=-3e-05, TE\_round=5e-15, TE\_abs=-3e-05, dx=1e-02, k=1**

**No10: Numerial=1.999966663500055030766588970437, Exact=2.0, TE\_t=3e-05, TE\_round=5e-15, TE\_abs=3e-05, dx=1e-02, k=2**

**No11: Numerial=1.003329998413139412249961424095, Exact=1.0, TE\_t=-3e-03, TE\_round=5e-16, TE\_abs=-3e-03, dx=1e-01, k=1**

**No12: Numerial=1.996635055138937353547134989640, Exact=2.0, TE\_t=3e-03, TE\_round=5e-16, TE\_abs=3e-03, dx=1e-01, k=2**

**2nd-order Accurate Central Difference for ∂u/∂x**

**No1: Numerial=0.999999999999999888977697537484, Exact=1.0, TE\_t=3e-03, TE\_r=1e-10, TE\_abs=1e-16, dx=1e-06, k=1**

**No2: Numerial=1.999999999999999777955395074969, Exact=2.0, TE\_t=3e-03, TE\_r=1e-10, TE\_abs=2e-16, dx=1e-06, k=2**

**No3: Numerial=0.999999999999999888977697537484, Exact=1.0, TE\_t=3e-03, TE\_r=1e-11, TE\_abs=1e-16, dx=1e-05, k=1**

**No4: Numerial=1.999999999999999555910790149937, Exact=2.0, TE\_t=3e-03, TE\_r=1e-11, TE\_abs=4e-16, dx=1e-05, k=2**

**No5: Numerial=1.000000000000000000000000000000, Exact=1.0, TE\_t=3e-03, TE\_r=1e-12, TE\_abs=0e+00, dx=1e-04, k=1**

**No6: Numerial=2.000000000000000000000000000000, Exact=2.0, TE\_t=3e-03, TE\_r=1e-12, TE\_abs=0e+00, dx=1e-04, k=2**

**No7: Numerial=1.000000000000133670852164868847, Exact=1.0, TE\_t=3e-03, TE\_r=1e-13, TE\_abs=-1e-13, dx=1e-03, k=1**

**No8: Numerial=2.000000000001266542426492378581, Exact=2.0, TE\_t=3e-03, TE\_r=1e-13, TE\_abs=-1e-12, dx=1e-03, k=2**

**No9: Numerial=1.000000001333365196032332278264, Exact=1.0, TE\_t=3e-03, TE\_r=1e-14, TE\_abs=-1e-09, dx=1e-02, k=1**

**No10: Numerial=2.000000012665563708935678732814, Exact=2.0, TE\_t=3e-03, TE\_r=1e-14, TE\_abs=-1e-08, dx=1e-02, k=2**

**No11: Numerial=1.000013365042300650387119276274, Exact=1.0, TE\_t=3e-03, TE\_r=1e-15, TE\_abs=-1e-05, dx=1e-01, k=1**

**No12: Numerial=2.000125565156342766215402662056, Exact=2.0, TE\_t=3e-03, TE\_r=1e-15, TE\_abs=-1e-04, dx=1e-01, k=2**

**2nd-order Accurate Central Difference for ∂2u/∂x2**

**No1: Numerial=-2.000000000055207394211720384192, Exact=-2.0, TE\_t=0e+00, TE\_r=4e-04, TE\_abs=6e-11, dx=1e-06, k=1**

**No2: Numerial=-4.000000000110414788423440768383, Exact=-4.0, TE\_t=2e-12, TE\_r=4e-04, TE\_abs=1e-10, dx=1e-06, k=2**

**No3: Numerial=-1.999999999987444487814514104684, Exact=-2.0, TE\_t=0e+00, TE\_r=4e-06, TE\_abs=-1e-11, dx=1e-05, k=1**

**No4: Numerial=-3.999999999771600922571224145941, Exact=-4.0, TE\_t=2e-10, TE\_r=4e-06, TE\_abs=-2e-10, dx=1e-05, k=2**

**No5: Numerial=-2.000000000000319744231092045084, Exact=-2.0, TE\_t=0e+00, TE\_r=4e-08, TE\_abs=3e-13, dx=1e-04, k=1**

**No6: Numerial=-3.999999979999819821330220293021, Exact=-4.0, TE\_t=2e-08, TE\_r=4e-08, TE\_abs=-2e-08, dx=1e-04, k=2**

**No7: Numerial=-2.000000000000048849813083506888, Exact=-2.0, TE\_t=0e+00, TE\_r=4e-10, TE\_abs=5e-14, dx=1e-03, k=1**

**No8: Numerial=-3.999998000000105413676010357449, Exact=-4.0, TE\_t=2e-06, TE\_r=4e-10, TE\_abs=-2e-06, dx=1e-03, k=2**

**No9: Numerial=-1.999999999777769765785251365742, Exact=-2.0, TE\_t=0e+00, TE\_r=4e-12, TE\_abs=-2e-10, dx=1e-02, k=1**

**No10: Numerial=-3.999800001222228118535895191599, Exact=-4.0, TE\_t=2e-04, TE\_r=4e-12, TE\_abs=-2e-04, dx=1e-02, k=2**

**No11: Numerial=-1.999997777777954732769671863934, Exact=-2.0, TE\_t=0e+00, TE\_r=4e-14, TE\_abs=-2e-06, dx=1e-01, k=1**

**No12: Numerial=-3.980012238871720953170552093070, Exact=-4.0, TE\_t=2e-02, TE\_r=4e-14, TE\_abs=-2e-02, dx=1e-01, k=2**

**1st-order Accurate Forward Difference for ∂2u/∂x2**

**No1: Numerial=-1.999997999786902402874488871021, Exact=-2.0, TE\_t=2e-06, TE\_r=4e-04, TE\_abs=-2e-06, dx=1e-06, k=1**

**No2: Numerial=-4.000001999955203224601518741110, Exact=-4.0, TE\_t=-2e-06, TE\_r=4e-04, TE\_abs=2e-06, dx=1e-06, k=2**

**No3: Numerial=-1.999979999997959723145868338179, Exact=-2.0, TE\_t=2e-05, TE\_r=4e-06, TE\_abs=-2e-05, dx=1e-05, k=1**

**No4: Numerial=-4.000019998592180492380521172890, Exact=-4.0, TE\_t=-2e-05, TE\_r=4e-06, TE\_abs=2e-05, dx=1e-05, k=2**

**No5: Numerial=-1.999800000002474043014899507398, Exact=-2.0, TE\_t=2e-04, TE\_r=4e-08, TE\_abs=-2e-04, dx=1e-04, k=1**

**No6: Numerial=-4.000199860015786867961651296355, Exact=-4.0, TE\_t=-2e-04, TE\_r=4e-08, TE\_abs=2e-04, dx=1e-04, k=2**

**No7: Numerial=-1.998000000999651692978886785568, Exact=-2.0, TE\_t=2e-03, TE\_r=4e-10, TE\_abs=-2e-03, dx=1e-03, k=1**

**No8: Numerial=-4.001986009503216479288312257268, Exact=-4.0, TE\_t=-2e-03, TE\_r=4e-10, TE\_abs=2e-03, dx=1e-03, k=2**

**No9: Numerial=-1.980000993131135311742241356114, Exact=-2.0, TE\_t=2e-02, TE\_r=4e-12, TE\_abs=-2e-02, dx=1e-02, k=1**

**No10: Numerial=-4.018609537196002001735450903652, Exact=-4.0, TE\_t=-2e-02, TE\_r=4e-12, TE\_abs=2e-02, dx=1e-02, k=2**

**No11: Numerial=-1.800933108950919070423424273031, Exact=-2.0, TE\_t=2e-01, TE\_r=4e-14, TE\_abs=-2e-01, dx=1e-01, k=1**

**No12: Numerial=-4.069811597832949878750241623493, Exact=-4.0, TE\_t=-2e-01, TE\_r=4e-14, TE\_abs=7e-02, dx=1e-01, k=2**