

Finite Difference Stencils: From Local to Global



2nd order FD (3 points)

x_{i-1} x_i x_{i+1}



4th order FD (5 points)

x_{i-2} x_i x_{i+2}



6th order FD (7 points)

x_{i-3} x_i x_{i+3}



Spectral (all points)

x_0 x_i x_N

As stencil width increases, accuracy improves. The spectral method is the limit: all nodes contribute to $u'(x_i)$.