Differentiation Error: Finite Differences vs Spectral Method

Test function:
$u(x) = 1/(2 + \sin(x))$
Domain: $[0, 2\pi)$ (periodic)

FD2 (order 2)
FD4 (order 4)
FD6 (order 6)
Spectral

$O(N^{-2})$
$O(N^{-4})$
$O(N^{-6})$

Maximum error $\|u' - Du\|_\infty$

Number of grid points N

Spectral accuracy!

Machine precision