NILT0, Achieved results for different values of t and M

Name : Mohammed Al shiuaili
ID: 20106181
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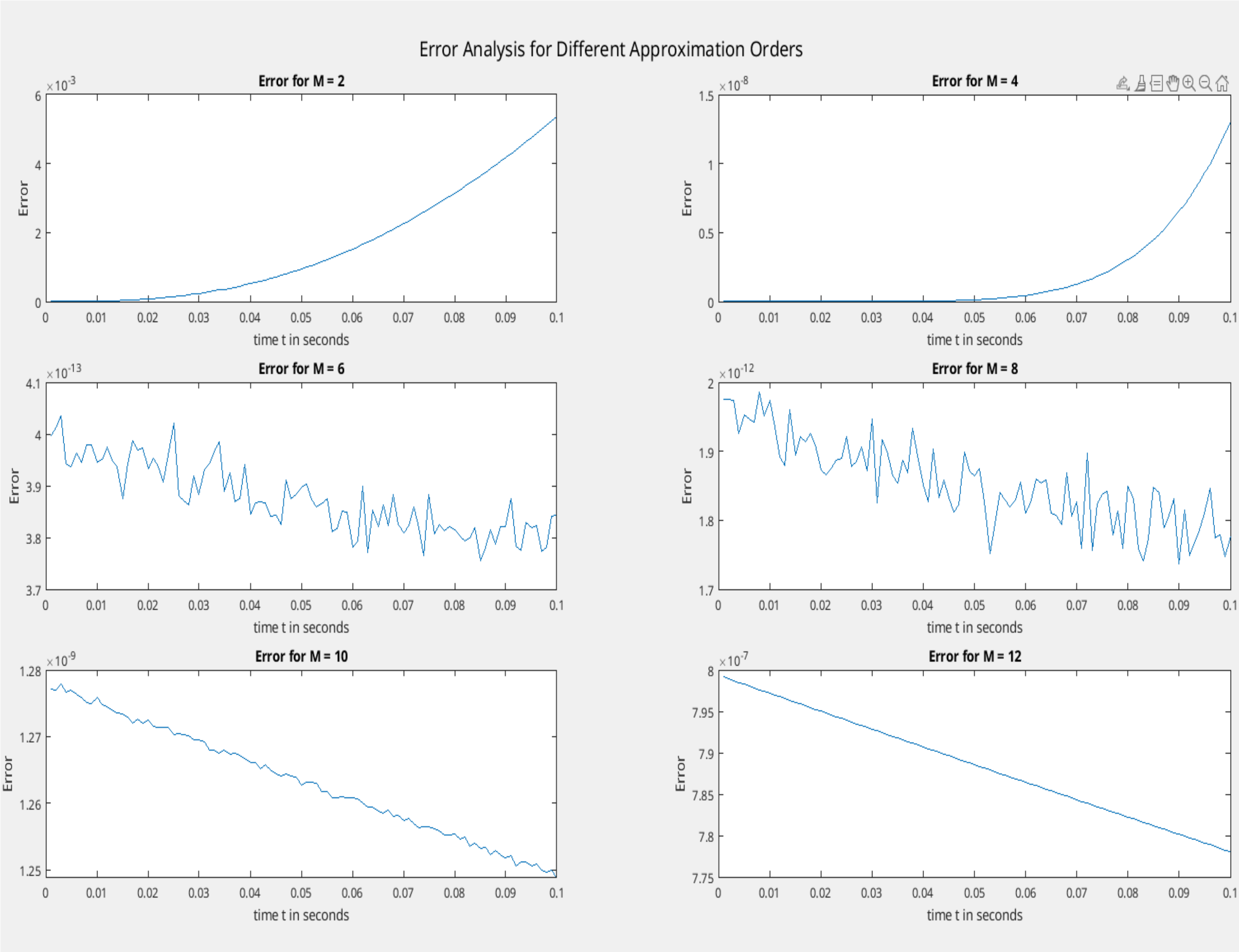
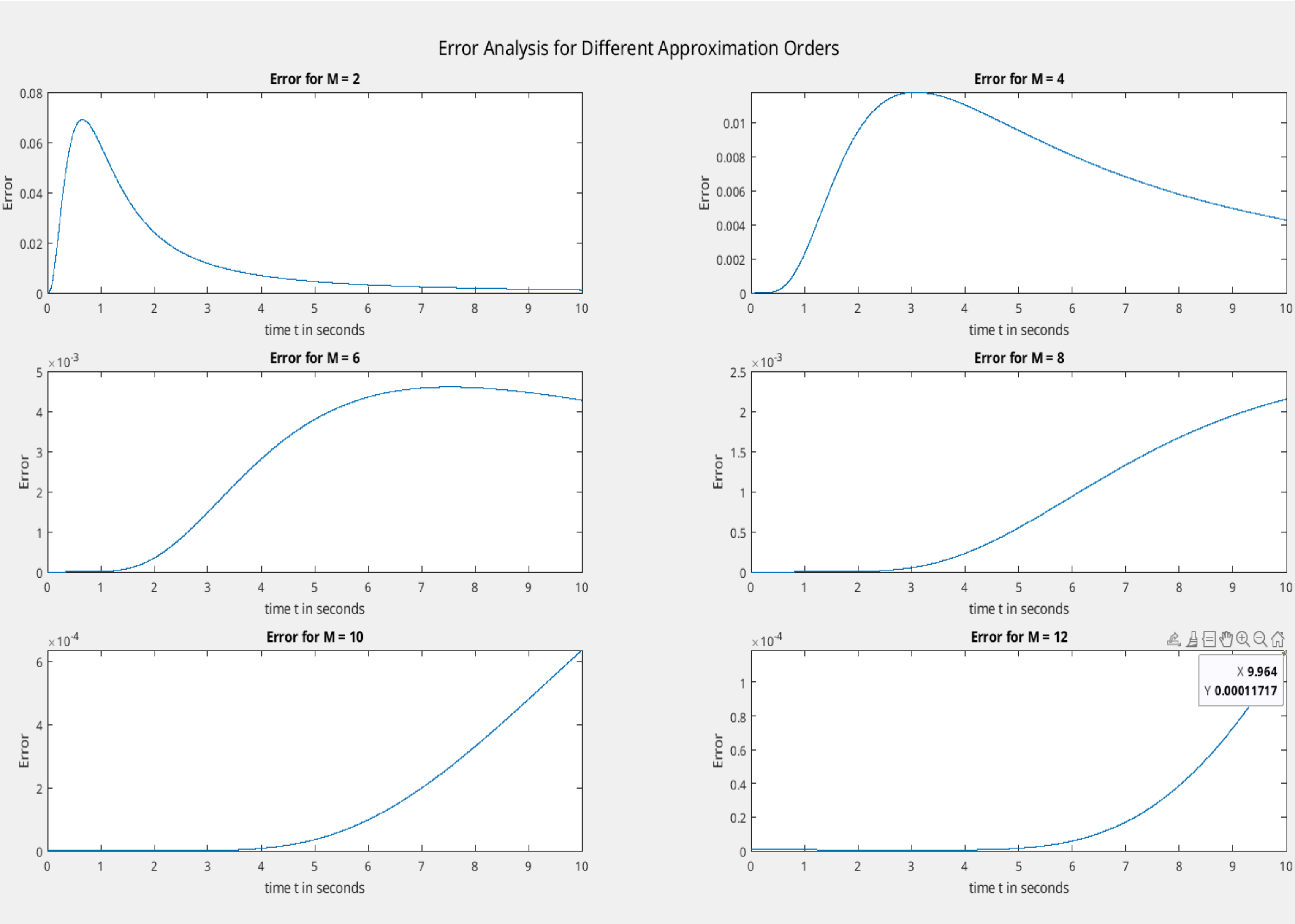
1. First test, changing the value of M, with the same t value and plot the error where the error = | exact solution - approximation |.

t = from 0 to 0.1 . 0:0.01:0.1;



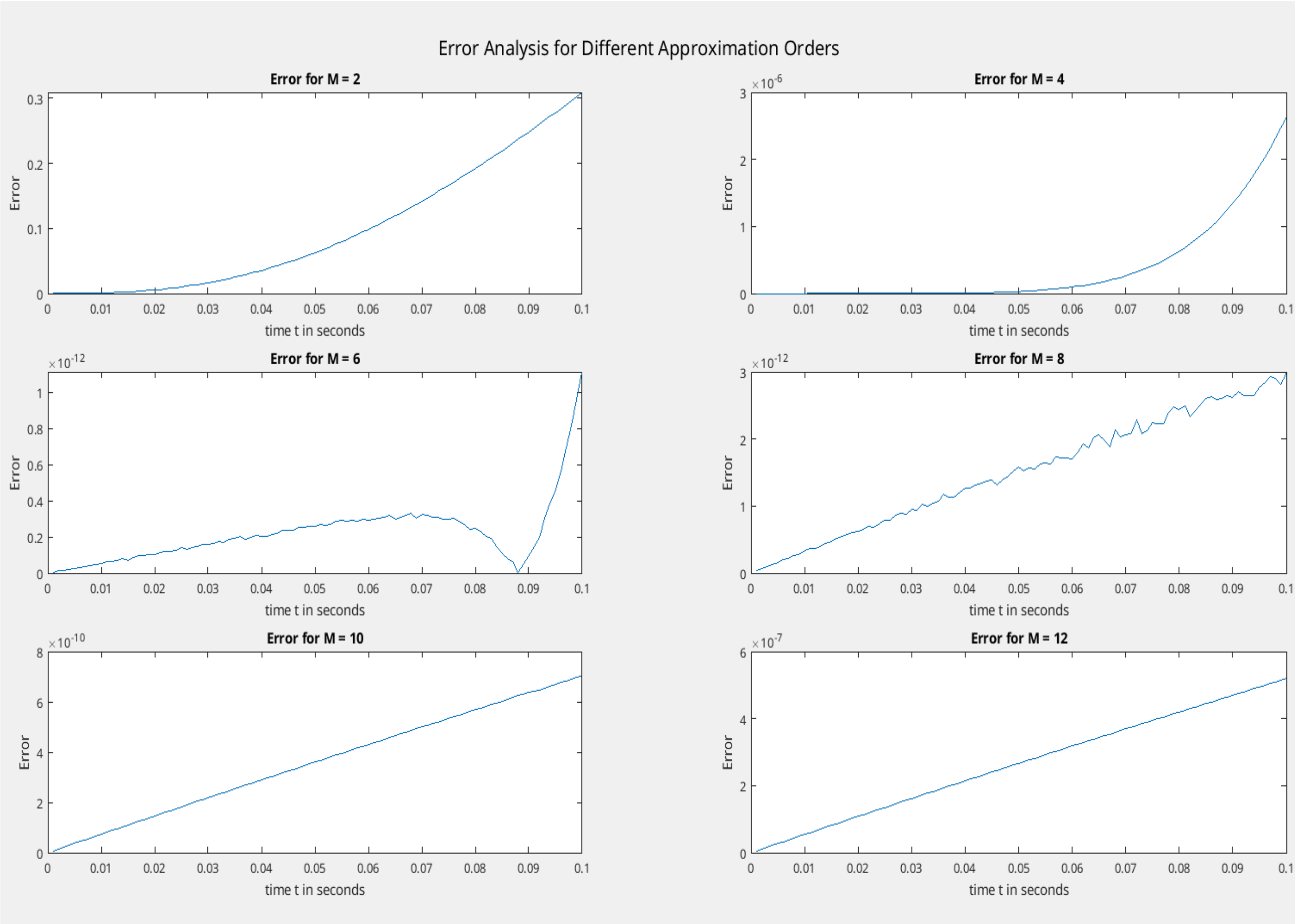
The plots show the error for different approximation orders (M) in a numerical inverse Laplace transform (NILT) method over time (t). It is observed that as the approximation order (M) increases, the overall error tends to decrease, indicating improved accuracy. For lower values of (M) (e.g., (M = 2) and (M = 4)), the error increases more significantly over time, showing a trend of exponential growth. However, for higher orders like (M = 6), (M = 8), (M = 10), and (M = 12), the error behaviour becomes more stable and shows much smaller magnitudes, often fluctuating or decreasing linearly. This highlights that higher approximation orders in NILT provide more accurate and stable solutions over time.

2. Change t to 0:0.001:10 (bigger t values)



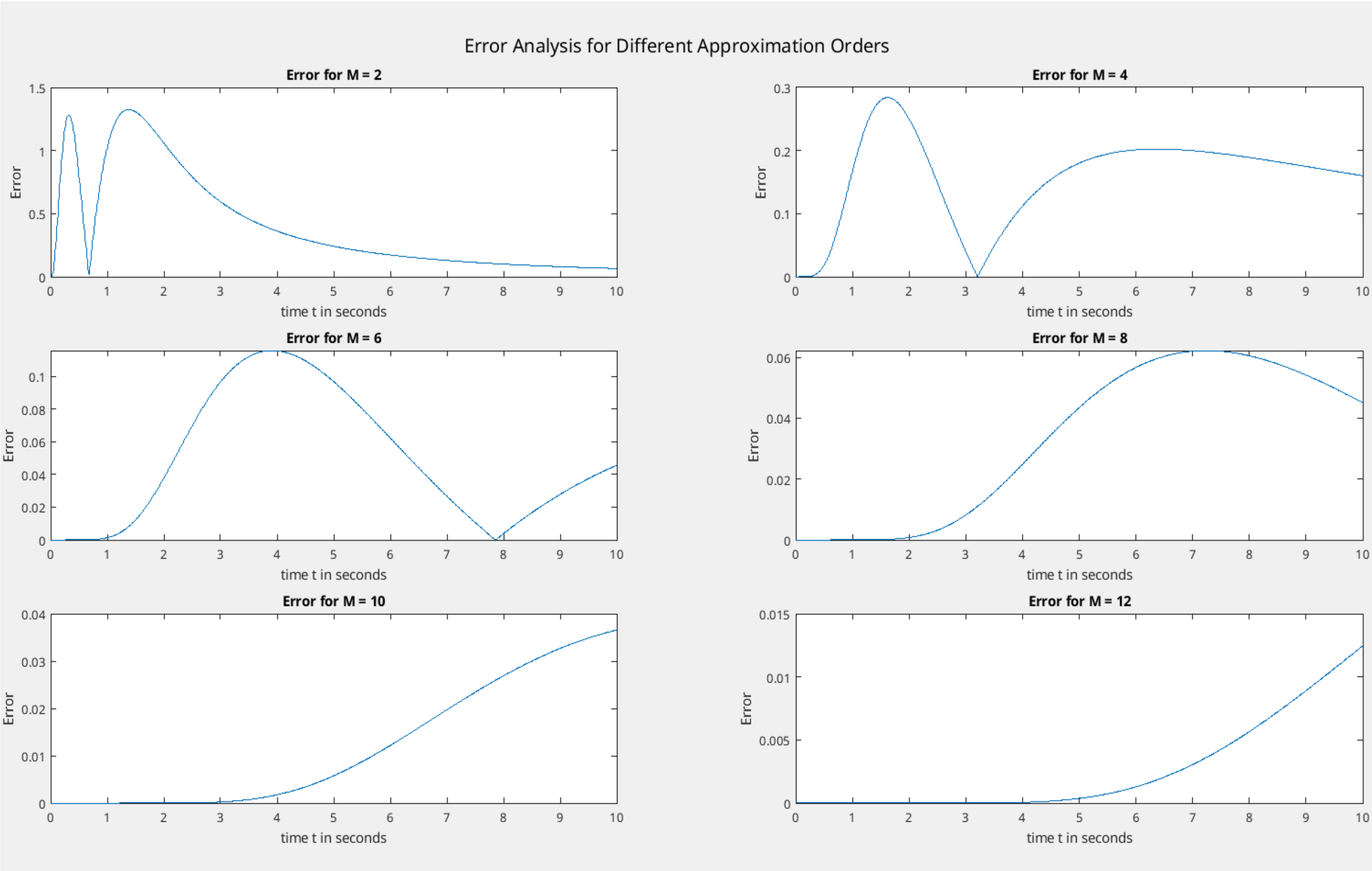
For lower M values (e.g., M=2 and M=4), the error initially rises, peaks around a few seconds, and then decreases, indicating that these approximations might perform better over longer time intervals. higher orders (M=10 and M=12) exhibit smaller, more stable errors throughout. These 2 tests were done on (1/s+4).

2. Second test, a second order transfer function (100/s^2+8s+15)



The plots show that lower orders (M = 2 and M = 4) have rapidly increasing errors, indicating less stability. As (M) increases (e.g., M = 10 and M = 12), the error grows more slowly and remains more controlled, meaning more accuracy and stability with higher approximation orders in NILT.

With t = 0 to 10 ,



At M = 2 and M = 4, the error was around 1.5 and 0.3, respectively, indicating that lower M orders have higher inaccuracies and more oscillations, suggesting less accurate approximations. However, at M = 10 and M = 12, the errors are minimal (around 0.03 and 0.015), with smoother and more stable curves, showing that higher approximation orders improve accuracy..