

MATLAB Marina: Numerical Integration

1. Write a MATLAB program that will:
 - Create a vector t consisting of 100 values over the interval of -5 to 5 seconds.
 - Evaluate the polynomial function $f(t) = -2t^2 + 3t + 7$ for the vector t .
 - Compute the definite integral of $f(t)$ for the range -5 to 5 seconds using the `trapz` function.
 - Compute the cumulative numerical integral of $f(t)$ using the `cumtrapz` function.
 - Compare the last value in the vector returned by the `cumtrapz` function for the cumulative numerical integral to the value obtained using the `trapz` function for the definite integral. The values should be the same (or very close).
 - Plot the function $f(t)$ and the cumulative numerical integral of $f(t)$ for the range -5 to 5 seconds in the same plot in a single figure window. Title and label the plot appropriately. A legend is appropriate here.
2. Write a MATLAB program that will:
 - Create a vector t consisting of 100 values over the interval of 0 to 8 seconds.
 - Evaluate the function $g(t) = 5te^{-0.5t}$ for the vector t .
 - Compute the cumulative numerical integral of $g(t)$ using the `cumtrapz` function.
 - Plot the function $g(t)$ and the cumulative numerical integral of $g(t)$ for the range 0 to 8 seconds in the same plot in a single figure window. Title and label the plot appropriately. A legend is appropriate here.
3. Write a MATLAB program that will repeat the operations of problem 2 except using only 20 values over the interval of 0 to 8 seconds for the t vector. How does the cumulative numerical integral of $g(t)$ with 100 values compare with the cumulative numerical integral of $g(t)$ with 20 values?
4. Write a MATLAB program that will:
 - Load the noisy voltage data from the file `nmdata.xlsx`. The data is in two columns: time and voltage. Each column of data has a text header.
 - Plot the voltage data. Title and label the plot appropriately.
 - Compute the cumulative numerical integral of the voltage data. In a new figure window, plot the cumulative integral of the data. Title and label the plot appropriately.

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