Weekly Report NILT

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Main objective:

Develop a code to implement NILT.

1. Rational Approximation

- The exponential term e^st == e^z is approximated by a rational function:

$$\xi_{N,M}(z) = \frac{\sum_{i=0}^{N} \alpha_{i,M,N} z^i}{\sum_{i=0}^{M} (-1)^i \alpha_{i,N,M} z^i}$$

Where ai,M,N is, $\alpha_{i,N,M} = \frac{(M+N-i)!}{(M+N)!}\binom{M}{i}$.

The code for this is developed in RationalApproximation.m where the code will take any value of N and M and calculate the Rational approximation based on the paper.

- I used the 'tf' function in matlab to express the approximation in a fraction.

2. Partial Fraction Expansion

We can then use partial fraction expansion to find p1,p2 ..etc and k1,k2,...etc. Next, these values can be used to approximate the function at a specific time point using NLIT.m where the code will take any function, and pass it to function NILT_approximation. This function will calculate the approximation around t using this formula.

$$-\frac{1}{t}\sum_{i=1}^{M} k_i X\left(\frac{p_i}{t}\right)$$

Then the output is printed out.

Next objective,

1. create a function to do Partial Fraction Expansion and extract poles and residues to be used in NILT_approximation function call.
2. Use this method to solve the transmission line equation.