

CEM833 Task 4:

FEM for 1D transmission line analysis

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This task is based on the following material:

- [1, Ch. 9]

1 Theoretical work

- Re-formulate the FEM formulation presented in [1, §9.2] in terms of the current as the unknown to be solved, rather than the voltage.
- Your formulation should include arbitrary source and load impedances via boundary conditions, as described in [1, §9.3.2].
- Solve the problem analytically, to be used as a reference when evaluating your numerical results.

2 Implementation

- In MATLAB, implement your FEM formulation to solve for the current along the line. Make sure that all of the problem setup parameters and the number of elements are constant that can easily be changed.

3 Verification

- Obtain a plot of the current on the line as a function of z . Compare the analytical and FEM results. Include multiple traces corresponding to various mesh sizes.
- Obtain a figure similar to [1, Fig. 9.11], with your code. Your figure needs only to show the first-order element case, as this is the type of element used in your implementation.
- Report and interpret your results.

References

- [1] D. B. Davidson. *Computational Electromagnetics for RF and Microwave Engineering*. Cambridge University Press, Cambridge, UK, 2nd edition, 2011.