The Method of Moments (Lab)

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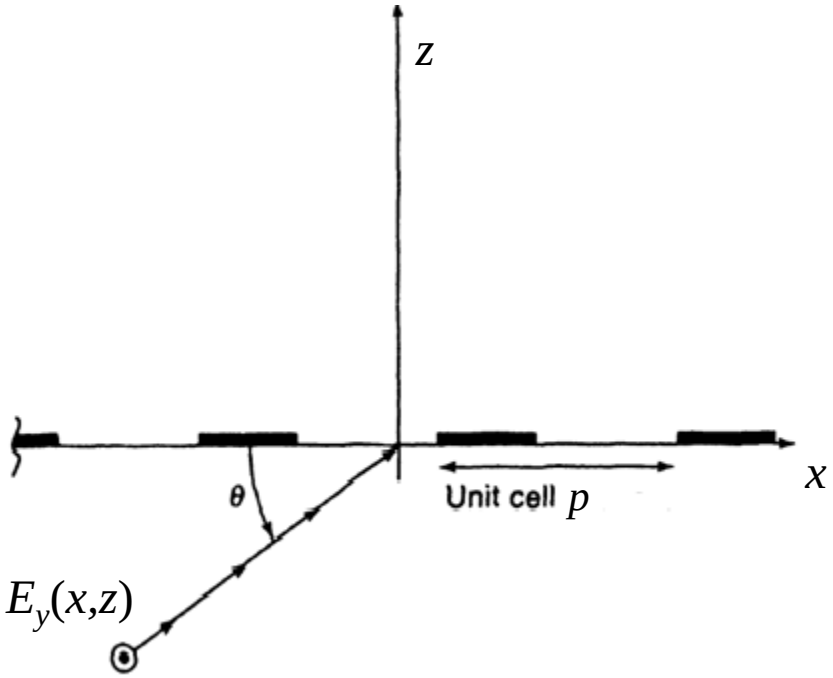
1 - Formulation of the Problem

1.1) Write an Electric-Field Integral Equation (EFIE) for our problem.

1.2) We will use piecewise-constant basis functions. Why is this possible?

1.3) By assuming a point-matching testing, write the entries of the MoM matrix.

1.4) By assuming a Galerkin testing, write the entries of the MoM matrix.



A. F. Peterson, S. L. Ray, and R. Mittra, *Computational Methods for Electromagnetics.* New York: IEEE Press, 1998.

2 - Green's Function Computation

2.1) Compute the periodic Green's function with the spectral sum in $-p/2 < x < p/2$ and $z = \lambda/5$ ($p = \lambda/3$)
Is the function singular? (use the function: Green_spectral)

2.2) Plot the decay of the first 10 harmonics of the spectral sum at $x = p/2$ and $z = \lambda/5$ (use semilog axes).

2.3) Plot the decay of the first 10 harmonics of the spectral sum at $x = p/2$ and $z = 0$ (use log axes).

2.4) Compare the periodic Green's function values computed with two different methods in $-p/2 < x < p/2$ and $z = \lambda/5$ ($p = \lambda/3$) with the Spectral sum and with the Ewald sums

2.5) Compute the periodic Green's function in in $-p/2 < x < p/2$ and $z = 0$ mm.
Which series would you choose?
Is the function singular?

3 - Matrix Entry Calculation

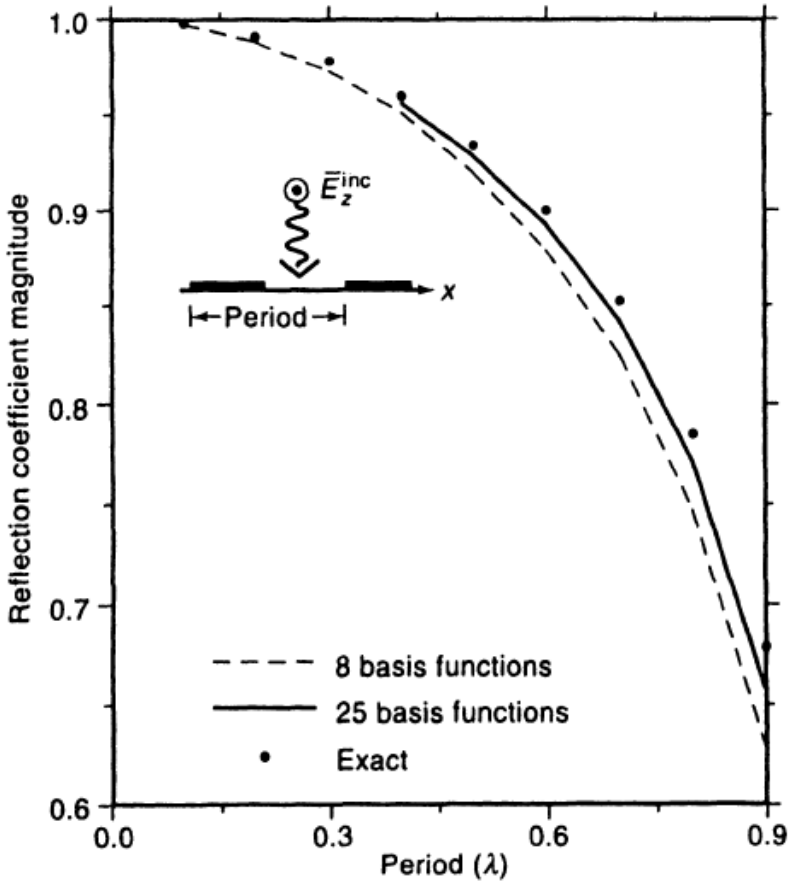
3.1) Compute the matrix entries with *a point matching* testing by integrating matrix entry with **quad** (for continuous functions) and with **integral** (for possibly singular functions).
Write the expression of the known term.

3.2) Compute the matrix entries with a *Galerkin* testing.
Can you identify the terms composing the diagonal entries?

3.3) Solve in both cases the MoM linear system and plot the magnitude of the current on a strip for different numbers of basis functions (N=3, ... 20). Discuss the computation time.

3.4) Compute the reflection coefficient (variable: Refl_coeff in the main).

case $w = p/2$
(can be solved in closed form)



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4 – Grounded Slab

3.1) Write the periodic Green's function of an array of line sources placed on the top of a grounded dielectric slab with $\varepsilon_r = 2.2$ and thickness $t = 0.5$ mm.
At $f = 10$ GHz, period $p = 30$ mm, width $w = 0.5p$, normal incidence,
plot the decay of the terms of the spectral series of this Green's function:

- with no acceleration
- extracting a free-space (air) Green's function
- extracting a free-space (arithmetic average of eps) Green's function

3.2) Write the forcing term in the integral equation corresponding to the strip grating printed on the grounded substrate described above.

3.3) Write the reflection coefficient of the 0th harmonic.

3.4) Compute the reflection coefficient in the range from 1 GHz to 10 GHz (same parameters as above).