Computational Electromagnetics: HW 2

Instructions: 1. You can solve this homework individually, or in groups of two. 2. For the computational problems, attach a copy of the code with the submission. 3. Make reasonable assumptions, STATE them, and include any references you might have used. 4. **[5 pts]** are reserved for neat and systematic presentation of results. 5. Plagiarism $\Rightarrow$ Course fail.
Total points: **[55]**. **Issued:** 24 Feb 2015, **Due:** 12 March 2015.

1) In class, we studied the linear vector space viewpoint of computational electromagnetics, i.e. finding a matrix representation of an operator equation (with suitably defined inner products):

$$\mathbb{L}f = g \tag{1}$$

for functions f, g and an operator $\mathbb{L}$. Now, express the 2D vector FEM problem that we studied in class in terms of such a view-point. Assume a total-field formulation, TM polarization, a first order ABC, and a simply connected domain. Be sure to (i) state what $\mathbb{L}, f, g$ correspond to, and (ii) write down the resulting matrix and vector elements.
[10 pts]. Must be done individually.

2) Re-consider problem 4 from the previous HW. Build a 1D frequency-domain scalar FEM method for solving either the periodic or the Fibonacci structure. You must write your own code; if you write it in Matlab, be sure that your system matrix is of sparse type so that it is efficiently solved. You may write it any other language as well. You should include (i) a plot of the reflection and transmission spectrum, (ii) observations on the comparison between FEM and FDTD for solving the same problem, and (iii) a discussion of which method is more suitable under what circumstances.
[40 pts]. Can be done in groups of two.