Solution steps

1. The given equations for the electric and magnetic fields are:

$$\frac{E_y(j,n+1)-E_y(j,n)}{\Delta t} = -\frac{B_z(j+1/2,n+1/2)-B_z(j-1/2,n+1/2)}{\Delta x}$$

$$\frac{B_z(j+1/2,n+1/2)-B_z(j+1/2,n-1/2)}{\Delta t} = -\frac{E_y(j,n)-E_y(j-1,n)}{\Delta x}$$

2. Implementing the Leapfrog Scheme:

- The leapfrog scheme requires updating the electric and magnetic fields alternately.
- For this implementation, let's assume periodic boundary conditions.

3. Initialization:

- Set initial conditions for E_y and B_z.
- Put an impulse at the center, e.g., $E_y(\frac{L}{2},0) = 1$

4. Update Equations:

- Update E_y using the previous B_z values.
- Update B_z using the newly computed E_y values.

5. Code Implementation

Code

- Correct parameters and initial conditions, e.g. initial impulse $E_y(\frac{L}{2}, 0) = 1$. [1]
- Correctly implement 1D-FDTD to calculate E_y and B_z based on eqn. (5) in the project handout.

```
Bz[j][n] = Bz[j][n-1] - (dt/dx)*(Ey[j+1][n] - Ey[j][n])
Ey[j][n+1] = Ey[j][n] - (dt/dx)*(Bz[j][n] - Bz[j-1][n])
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[10]

- Looping through the space index j and the time index n. [2]
- Plot E_z and B_y (against x and t, or against x and animate through t). [2]

[Code: 15]

Results and Visualization

The result should show the changes in E_y and B_z with respect to space and time. Preferably, it should be the plot of the fields against x and animate through time t. But the 3D plot of the fields against x and t is also acceptable. Figures below show some snapshots of the animation through time t.