Homework 4: Tetrahedron & HFSS Cube RCS

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ECE 5973-004

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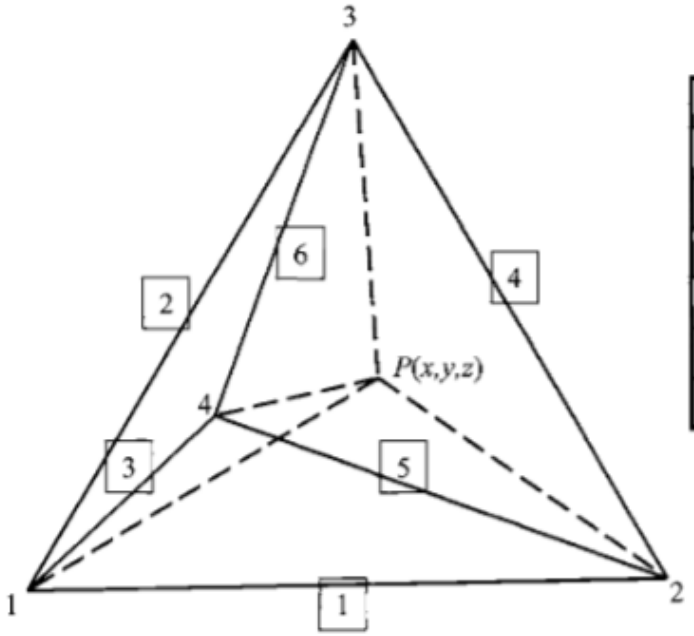
Question 1:



Edge k	Node i	Node j
1	1	2
2	1	3
3	1	4
4	2	3
5	4	2
6	3	4

Figure 1: Figure 3.28 from the textbook displaying tetrahedron.

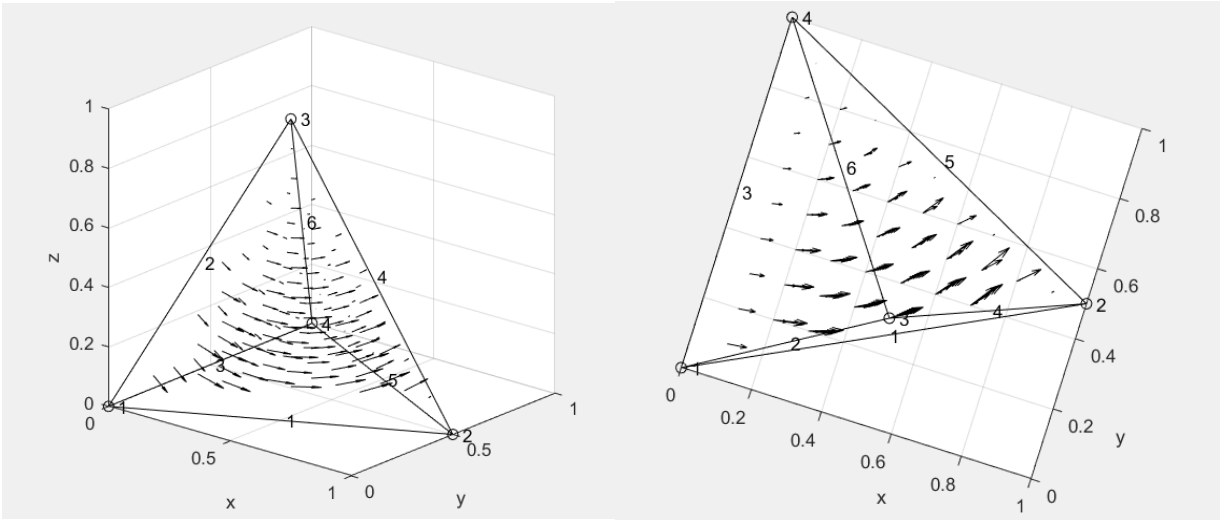


Figure 2: MATLAB Basis Function representation using FEM.

The above representation in MATLAB describes the fundamental principles of base function fields through its behavior. The basis functions represent a change in the vector field within the tetrahedron and each is associated with an edge or point. The direction and magnitude of the vectors show how the field varies. The behavior suggests several things about the system, for instance, the curl of the field is nonzero, there is some symmetry in the field, and that the

orientation of the filed is in one direction. The data from MATLAB shows that the vector field rates around edge six and points three and four. This is consistent with Figure 3.29 of the textbook.

Question 2:

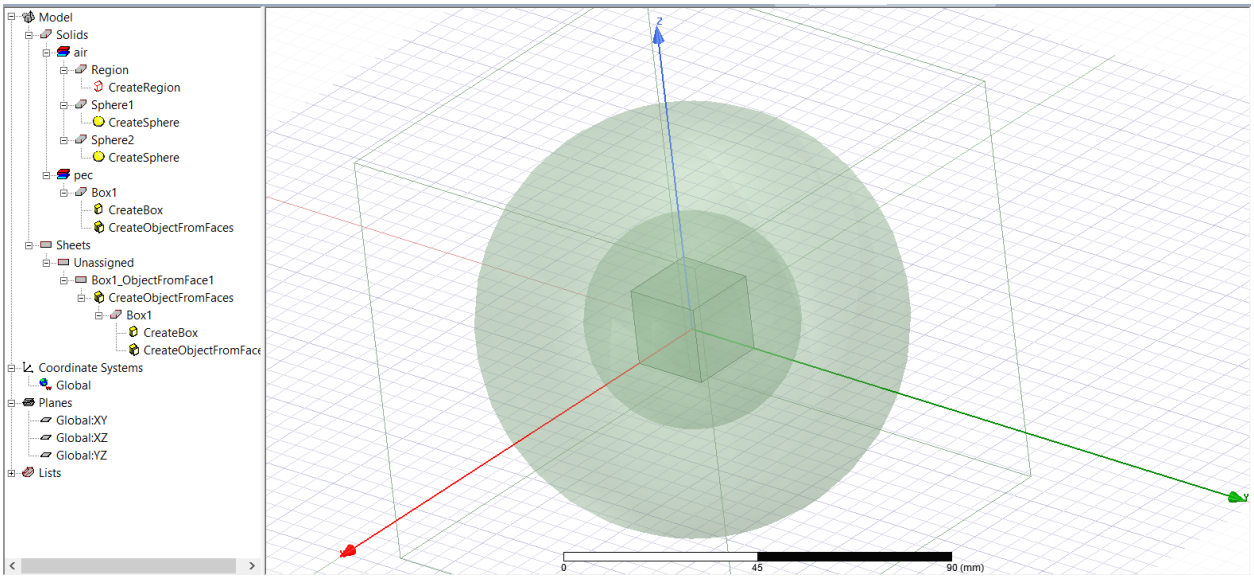


Figure 3: ANSYS HFSS PEC Box with air cube for radiation analysis.

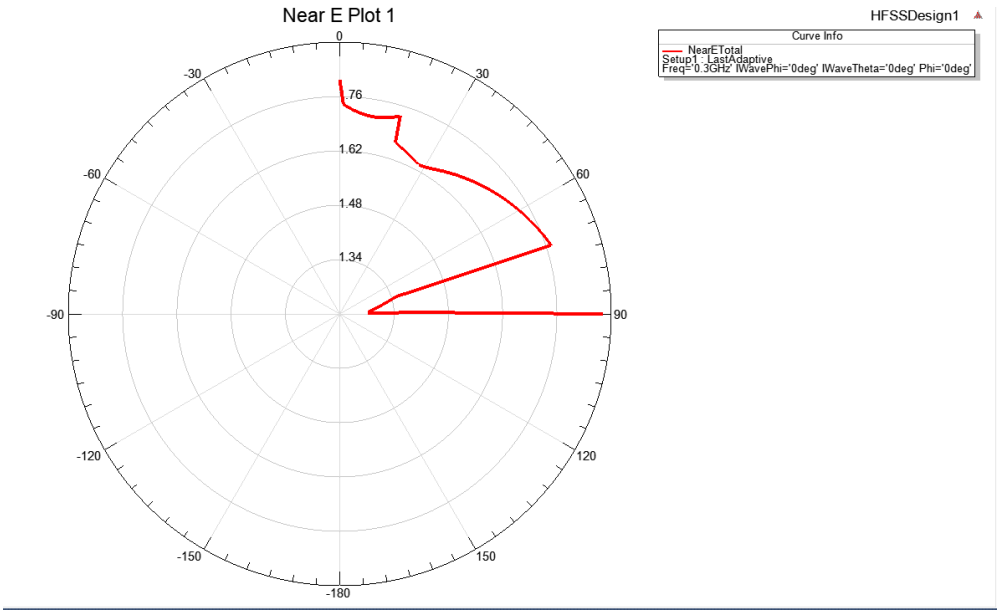


Figure 4: Near Field Radiation Pattern of PEC Box Monostatic.

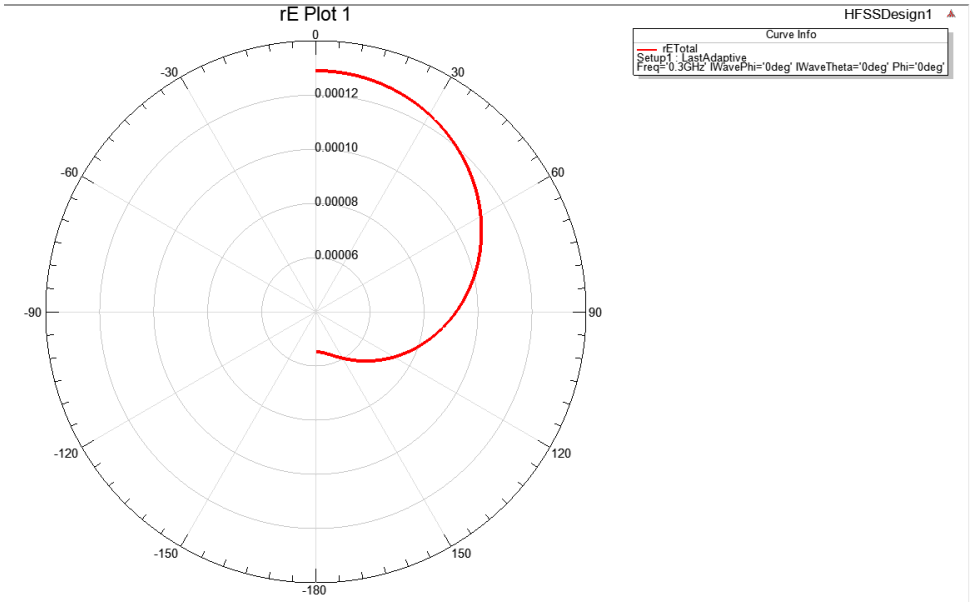


Figure 5: Far Field Radiation Pattern of PEC Box BiStatic.

The near and far field radiation patterns for the box are shown in Figures 4 and 5. These patterns were generated using a radiation boundary layer. When changing this boundary layer to a PML, we would expect the radiation pattern in the near field to stay the same, and the radiation pattern in the far field to be more accurate. It can also be expected that the PML simulation will increase processing time and may induce instability. For this project, an accurate PML was unable to be generated due to mismatched materials errors. However, due to the properties of PML, if a PML would have been implemented, it would be more accurate than the radiation boundary used for the near and far field radiation patterns.