The FDTD method is a versatile numerical simulation method that is used in an increasingly wide range of fields. During this semester I have been investigating the concept on which the method is based and determine shortcomings that it may have. How to know when you are obeying the rules of the algorithm in order to get an accurate model formed the control problem that we considered. The analysis presented here is based on Dennis M. Sullivan’s book *Electromagnetic Simulation Using the FDTD Method* as well as a vast collection of online resources helping the method to be modeled in MATLAB. Comparison of the C and MATLAB codes provided a good base of information on how to simplify any given propagation into a problem of generating the proper grid space. The investigation began with a bare bones algorithm in 1D with a pulse source propagated symmetrically in both directions. The first modification to this code was changing the pulse to any number of sources and adding a condition so that it propagated in one direction only. Realizing that the grid space is the only thing that changes when the fields are updated created a method for creating specific boundary conditions (ABC and PEC/PMC) and bridged the gap between modeling in free space vs modeling dielectrics and dielectric interfaces. The systematic update of the field vectors at all points make modeling a new structure easy, simplifying the problem to that of generating a stable grid for our problem space. This method is important because it is rooted in such a simple algorithm allowing individual conditions to be added for a wide variety of applications.