FDTD method is based on Maxwell's equations and this thesis describe how to make these differential equations computer readable for numerical solution known as the Yee algorithm. Time step dependence on spatial step is examined here in order to obtain stable solution. Discrete Fourier trasform is defined to obtain frequency dependent transmission and reflection coefficients. Programmed simulation is tested on analytically solvable structures even on slightly more complex systems whose optical response was computed by other type of simulation. Finally photonic crystals and their application as biosensors are discussed. Particular shape of photonic crystal is examined in details (frequency spectrum dependence upon spatial resolution, inaccuracy in geometry, different compounds in holes, geometry modification).