Public Abstract
Suresh Kranthi Nakka
M.S.
Electrical and Computer Engineering
Charge Collection Mechanisms in a Sub-Micron Grated MSM Photodetector: Field Analysis
Advisor: Dr. Naz E. Islam
Graduation Term Summer 2005

This project deals with the study of enhanced collection mechanisms due to sub-micron wall-like silicon structures on the active surface of a Metal-Semiconductor-Metal (MSM) photodetector. The amplitude of a normal incident electromagnetic wave is considered for analysis, as it travels through the grated walls into the device active region. A change in the amplitude determines the transmission coefficient and hence the energy deposited in the active region. Analysis shows that a wall-like grating could improve the collection efficiency and rearranging the wall gratings to a square lattice (cubic or rectangular shaped structures) could improve the charge collection efficiency even further.

Further simulations were done to show that there exists a certain critical percentage of the area covered by the gratings over the detector after which the charge collection efficiency starts to decrease. It is also shown that there is less possibility for the incident wave to leak away from the surface for the case of square shaped gratings than the cone shaped gratings. For higher power transmission into the detector active region, the square silicon gratings were doped with a material of refractive index lesser than that of the silicon, so that most of the incident wave is reflected towards the interface.