



COLLEGE OF ENGINEERING & TECHNOLOGY

Department: Electronics and Communications Engineering, Cairo

Graduation Project Description Form

Project Title: Optical Cloaking using Metamaterials: Carpet Cloaks

Duration from mo/year till mo/year

Project Supervisor(s): Dr. Hussien Ghaz,

Product Category

Algorithm Hardware Software _____

Standards:

Safety: UL, CE _____ IEEE _____ FCC _____ Other _____

Practical Realization Form

PCB _____ Firmware _____ Embedded CPU Kit (ARM, ..etc): _____

PC Software _____ Ready-made Package _____ DSP Kit _____ FPGA Kit _____

VLSI Schematics _____ VLSI Layout _____ VLSI Silicon (ASIC) _____

Language

VHDL/Verilog _____ Matlab _____ C/C++/Java _____

Productization

Finished Product Form: _____ Possible Commercialization _____

Amount of funds needed for buying components: _____

IEEE GOLD Made-In-Egypt/Engineering Day: _____

ITAC (ITIDA) or NTRA Funding Application: _____

Testing

Functional _____ Simulation _____ Parameters _____ Final Hardware _____ Other:

Lab Test Setup

EMC _____ Environmental _____ Microwave _____ Analog Lab _____ Other:

CAD Tools (*No unauthentic software is allowed*):

Elective Classes Required:



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Abstract

Metamaterials are artificially structured composites consisting of well-arranged periodic inclusions of subwavelength dimensions which show peculiar electromagnetic properties. As the whole composite has new effective parameters ϵ_{eff} and μ_{eff} , we can use these properties to achieve abnormal electromagnetic phenomena which would be impossible to achieve using the conventional materials.

One of the applications and very interesting phenomenon that can be realized using metamaterials is optical invisibility. Until now, however, cloaking techniques have come with a significant limitation—they need to be orders of magnitude larger than the object being cloaked. This size limitation can be overcome by using a technology known as “carpet cloaks” which is a 2-D cloaking technique.

In carpet cloaks, the object which is desired to be made invisible must be oriented on a ground plane or in front of a wall. They work by disguising the object from light - making it appear as a flat plane using graded refractive index materials to guide the light rays within.

The aim of this project is to design a carpet cloak at a certain operating frequency, lying within the optical spectrum, and simulating this design using a simulation tool, e.g. Comsol Multiphysics, Lumerical and CS Studio.



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References and Links