Department of Electrical and Computer Engineering
North South University

Senior Design Project

Design of a wideband metamaterial absorber for optical wavelength applications based on Hadamard matrix

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Fall, 2021

DECLARATION

This is to certify that this Project is our original work. No part of this work has been submitted elsewhere partially or fully for the award of any other degree or diploma. Any material reproduced in this project has been properly acknowledged.

Students' name & Signature

1. ***Erik Upol Biswas***

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2. ***Salman Meem Sahel***

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3. ***MD. Moin Ebne Kamal***

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APPROVAL

The capstone project entitled "**Design of a wideband metamaterial absorber for optical wavelength applications based on Hadamard matrix**" by **Erik Upol Biswas (ID#1811317043), Salman Meem Sahel (ID#1813077043),** and **MD. Moin Ebne Kamal (ID #1811877043)** is approved in partial fulfillment of the requirement of the Degree of Bachelor of Science in Computer Science and Engineering on January and has been accepted as satisfactory.

Supervisor's Signature

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ACKNOWLEDGMENT

First of all, we wish to express our gratitude to the Almighty for giving us the strength to perform our responsibilities and complete the report.

The capstone project program is very helpful to bridge the gap between the theoretical knowledge and real life experience as part of Bachelor of Science (BSc) program. This report has been designed to have a practical experience through the theoretical understanding.

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ABSTRACT

It can be a complex and daunting task to achieve broadband absorption, in this work we demonstrate a polarization insensitive ultrathin metamaterial (MM) absorber based on the Hadamard-matrix. Within the optical domain, the demonstrated MM absorber showcases absorption of over 91% for both transverse electric (TE) mode and transverse magnetic (TM) mode. To explore the angular dependence on absorption features of our Hadamard-matrix meta-absorber (HMMA), both TE and TM modes are used at numerous incident-angles. Finite integration technique was utilized to simulate the demonstrated MM absorber design and validated using the interference theory model to assure the simulated data. Moreover, electric and magnetic field characteristics, current distributions, and a plethora of parametric sweeps were also investigated in order to better understand the suggested HMMA absorption mechanism. Because of its wideband absorption and polarization insensitive characteristic, this MM absorber based on the Hadamard-matrix arrangement permits a variety of applications such as light detectors, optical-sensors, magnetic resonance imaging, plasmonic-sensors, and thermal imaging applications.