



شبكة المعلومات الجامعية  
التوثيق الإلكتروني والميكروفيلم

# بسم الله الرحمن الرحيم



**MONA MAGHRABY**



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التوثيق الإلكتروني والميكروفيلم



# شبكة المعلومات الجامعية التوثيق الإلكتروني والميكروفيلم



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# جامعة عين شمس

## التوثيق الإلكتروني والميكروفيلم

### قسم

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**MONA MAGHRABY**



**MONTE CARLO SIMULATION AND 3D FINITE  
ELEMENT ANALYSIS OF THE FEMALE GENITAL  
ORGANS FOR THE EARLY DETECTION OF  
CERVICAL CANCER**

By

**Samar Mohamed Abd El-Fattah Kamel**

A Thesis Submitted to the  
Faculty of Engineering at Cairo University  
in Partial Fulfillment of the  
Requirements for the Degree of  
**MASTER OF SCIENCE**  
in  
**Biomedical Engineering and Systems**

FACULTY OF ENGINEERING, CAIRO UNIVERSITY  
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**Title of Thesis:**

Monte Carlo simulation and 3D finite element analysis of the female genital organs for the early detection of cervical cancer.

**Key Words:**

Cervical Cancer; Monte Carlo; Finite Element Method; Female Genital Organs; Photoacoustic Imaging.

**Summary:**

We present a complete photoacoustic (PA) analysis for the early detection of cervical cancer using 3D realistic anatomical MRI models of the female genital organs. Models represent a normal healthy cervix and two abnormal cases; early and advanced stages of cancer. Nine constructed 3D models representing FIGO cervical cancer staging were also simulated in this study. Monte Carlo simulations are used to compute fluence maps for the different models at  $\lambda = 633$  nm. Thermal, structural and acoustical analyses are performed using the FEM. Results showed that there is a significant change in the detected PA signals for abnormal cervix tissues (containing a tumor) as compared to healthy cervix tissues when the transducer was placed trans-vaginally which proves that we are able to differentiate between cancer stages. Thus, results provide insights into using PA imaging for the detection of cancers at early stages.

## **Disclaimer**

I hereby declare that this thesis is my own original work and that no part of it has been submitted for a degree qualification at any other university or institute.

I further declare that I have appropriately acknowledged all sources used and have cited them in the references section.

Name: Samar Mohamed Abd El-Fattah Kamel

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# **Dedication**

I would like to dedicate this work to every single person who encouraged me once to continue and keep up the good work, to those persons who believed in me, to whom their gentle and kind words were a source of power...

Thank you for your help, encouragement and support.

*Samar Mohamed*

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