

بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

# الآية

قال الله سبحانه وتعالى : ﴿ إِنَّ اللَّهَ لَا يَسْتَحْيِي أَنْ يَضْرِبَ مَثَلًا مَّا بَعُوضَةً فَمَا فَوْقَهَا فَأَمَّا  
الَّذِينَ آمَنُوا فَيَعْلَمُونَ أَنَّهُ الْحَقُّ مِنْ رَبِّهِمْ وَأَمَّا الَّذِينَ كَفَرُوا فَيَقُولُونَ مَاذَا أَرَادَ اللَّهُ بِهَذَا  
مَثَلًا يُضِلُّ بِهِ كَثِيرًا وَيَهْدِي بِهِ كَثِيرًا وَمَا يُضِلُّ بِهِ إِلَّا الْفَاسِقِينَ ﴾

(سورة البقرة الآية (٢٦))

# **DEDICATION**

This project is dedicated to...

My beloved **Mother** and **Father**

For their endless love, support and encouragement.

**Brothers** and **Sisters**

and

To those who accompanied me in path of friendship

## **Acknowledgment**

Am thankful to Almighty **ALLAH**, most gracious, who in his infinite mercy has guided me to complete this project.

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## **Abstract**

The importance of micro biomedical instrument has been grown in high rate and faster than in previous decades. This acceleration was primary due to, the increase and demand for high quality medical care in the developed countries, and also due expansion in Microelectromechanical System (MEMS) technologies. The Measurement of glucose is the great and important in diagnosis, especially in the essential of continuous monitoring for patients are suffering from diabetes mellitus which is caused by the frequencies levels of glucose in human physiological fluid. This research focuses on the design , simulation and analysis for a Piezoresistive Microcantilever of Glucose Sensing. The adsorption of glucose in the surface of the cantilever will cause a surface stress and consequently the cantilever bending, and bending analysis is performed, that the microcantilever tip deflection could be predicted. This model simulated with a finite element analysis tool designed specifically for (MEMS) applications. The Design used different materials and analyzed the main characteristics with the package (ANSYS). The Structural variation of the piezoresistor design's on microcantilever is also considered to increase the sensitivity of the microcantilevers sensor since the forces involved is very small.

## مستخلص

تزايدت في العقد الاخير أهمية المعدات الطبية الحيوية الصغيرة بمعدل اسرع مما كان عليه في العقود السابقة ، وكان هذا التسارع نتيجة للطلب المتزايد علي الرعاية الطبية الحديثة عالية الجودة في البلدان المتقدمة جدا ، وايضا التوسع في تقنية ال(MEMS) .

قياس الجلوكوز ذو أهمية كبيرة في التشخيص، وهذا أمر ضروري خاصة للمراقبة المستمرة لمريض يعاني من داء السكري الذي ينجم عنه تذبذب مستويات الجلوكوز في السائل الفيزيولوجي البشري .

وقد ركز هذا البحث على تصميم ، تحليل و محاكاة عارضة كابولية دقيقة بيزورزيستف لتحسس الجلوكوز . من حيث المبدأ، امتصاص الجلوكوز على سطح عارضة كابولية دقيقة سيُسببُ إجهاد سطحي وبناء عليه ينحني ، ويتم تحليل انحناء العارضة الكابولية الدقيقة بحيث يمكن توقع انحراف صغير في الرأس . صمم باستخدام موادَ مختلفةً وتم تحليلَ الخصائص الرئيسية باستخدام برنامج المحاكاة (ANSYS).

تم محاكاة نموذج المصممة خصيصا لتطبيقات (MEMS) ، ويعتبر الاختلاف البنيوي لتصاميم البيزورزيستف في تصميم العارضة الكابولية الدقيقة مما ادي الي زيادة حساسية أجهزة استشعار العارضة الكابولية الدقيقة ؛ حيث القوى المشاركة صغيرة جدا.

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## **List of abbreviation**

<b>MEMS</b>	<b>Micro ElectroMechanical Systems</b>
<b>FEM</b>	<b>Finite Element Method</b>
<b>CMOS</b>	<b>Complementary Metal-Oxide Semiconductor</b>
<b>BPSG</b>	<b>BoroPhosphoSilicate Glass</b>
<b>CVD</b>	<b>Chemical Vapor Deposition</b>
<b>CAD</b>	<b>Computer Aided Design</b>
<b>PZR</b>	<b>Piezoresistive</b>
<b>DOF</b>	<b>Degree Of Freedom</b>

## List of Symbols

**$K$  = the gauge factor of piezoresistor.**

**$M_0$  = the applied concentrated moment.**

**$E$  = the modulus of Elasticity**

**$I$  = the moment of inertia of the beam.**

**$\nu$  = the Poisson's ration .**

**$h$  ,  $x$  = the radius of curvature and thickness of microcantilever beam.**

**$E_1$  = the Young's modulus of the polysilicon cantilever beam.**

**$h_1$  = thickness of the polysilicon cantilever beam.**

**$E_2$  = the Young's modulus of the piezoresistor.**

**$H_2$  = thickness of the piezoresistor.**

**$Z_T$  = the distance from neutral axis to top of the cantilever beam containing piezoresistor.**

**$\Delta\sigma_s$  = differential surface stresses on the surface of the microcantilever**