

# Dedicatio n

To whom my words are not enough to expiree my deep indebtedness, thanks and gratefulness.

To my parents the sustainable source of tenderness, kindness and endless support and specific.

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colleagues, friends, relatives  
and teachers.

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## Abstract

In this work an optical fiber current sensor was designed and implemented using helium-neon laser (with wavelength of 632.8 nm and power of 1 mW) as light source, single mode fiber based sensing element and photomultiplier as detector. The optical sensors used for measuring electrical currents are, in fact, magnetic field sensors based on the magneto-optic Faraday Effect in optical fiber, and its importance is coming from the fact that measuring electrical currents in high voltage substations using conventional current transformers (CT) utilize an iron core and windings ratio to step down the current measured in the primary to a more manageable current level for secondary devices such as meters and relays. This signal may be distorted due to saturation of the magnetic core or electromagnetic waves interference, and it is usually an issue that involves a great deal of insulation.

The use of optical technology in this field greatly reduces the need for insulation considering its intrinsic dielectric characteristics and immune from electromagnetic interference.

This sensor is presently designed to cover current in the range of (20 A to 450 A). Preliminary experimental results for an optical fiber current sensor are presented. The sensor gave good results under various

electrical current supply values, and responded in a linear fashion to an applied electric current. The results proved that the optical fiber current sensors can be used in high voltage substations due to their superior accuracy, bandwidth, dynamic range and inherent isolation.

## الخلاصة

في هذا البحث تم تصميم وبناء متحسس ضوئي لقياس التيار الكهربائي العالي في مدى الكيلو أمبير (20 أمبير — 1000 أمبير) . المتحسس الضوئي تتكون من ليزر الهليوم - نيون ذي الطول الموجي 632.8 نانومتر وبقدرة 1 ملي واط كمصدر ضوئي و ليف بصري أحادي النمط يعمل كعنصر تحسس وكاشف ضوئي لتسجيل التغيرات في شدة شعاع الليزر . هذا المتحسس البصري يعمل علي مبدأ تأثير فراداي المغنطيسي الضوئي (-Magneo optic Faraday Effect) . ان اهمية مثل هذا المتحسس تأتي بسبب ان قياس التيار الكهربائي في محطات الجهد العالي الفرعية في انظمة القدرة الكهربائية باستخدام محولات التيار ذات القلب المغنطيسي تظهر بعض المشاكل خاصة التشوه في خرجها في حالة الاعطال حيث تكون التيارات عالية جداً. هذه التشوهات تكون نتيجة للتشيع في القلب المغنطيسي او تكون نتيجة للتداخلات الكهرومغنطيسية . وكذلك هذه المحولات تتطلب عزل ضد الجهود العالية وهذا مكلف , في حين ان الطرق الضوئية يمكنها حل هذه المشكلات . تم إختبار المتحسس لقياس التيار بتطبيق تيار كهربائي في المدى ما بين (20 أمبير — 450 أمبير) .

أظهر المتحسس نتائج جيّدة في المدى المذكور ودقة عالية بالإضافة الى استجابة خطية للتيار الكهربائي المطبق. اثبتت النتائج انه يمكن إستخدام المتحسس الضوئي لقياس التيار في محطات الجهد العالي الفرعية او لقياس التيار في محطات التوليد نتيجة للدقة العالية والمدى العريض للاقياس , وكذلك لعدم حاجته للعزل ضد الجهود

العالية , و لمناعته ضد التداخلات الكهرومغناطيسية والتداخلات الراديوية , ولصغر  
حجمه وسهولة تركيبه.

# Contents

Acknowledgement.....	ii
Dedication.....	iii
Abstract English).....	iv
Abstract (Arabic).....	v
Contents.....	vi

## **Chapter one: Introduction and concepts**

1.1 General introduction .....	1
1.2 Power system measurements.....	2
1.2.1 Electric <b>current measurement techniques</b> .....	<b>4</b>
1.2.1.1 Current transformers .....	4
1.2.1.2 Hybrid optical current probe.....	5
1.2.1.3 Optical current sensors .....	6

1.2.2 Saturation in conventional current transformer .....	9
1.3 Aim of the work.....	10

## **Chapter two: Laser and optical fiber**

2.1 Lasers .....	11
2.2 Laser properties .....	12
2.2.1 Brightness .....	12
2.2.2 Monochromaticity.....	12
2.2.3 Coherence .....	13
2.2.4 Directionality .....	14
2.3 Laser types.....	15
2.3.1 Insulating solid (solid state) lasers .....	15
2.3.2 Liquid lasers.....	15
2.2.3 Semiconductor lasers .....	15
2.3.4 Gas lasers .....	16
2.4 Optical fiber and its basic construction .....	18
2.4.1 Optical fiber classification.....	19
2.4.2 Multimode optical fiber.....	21
2.4.3 Single -mode fiber.....	22
2.4.4 Optical fiber transmission characteristics .....	24
2.4.4.1 Attenuation of signal in optical fiber.....	24
2.4.4.2 Dispersion of signal in optical fiber.....	27
2.5 Polarization behaviour in optical fiber.....	30
2.5.1 Polarization .....	30
2.5.2 Polarization- maintaining fiber .....	31
2.6 Faraday Effect .....	32
2.7 Optical detectors .....	34
2.7.1 Photodetector characteristics .....	34

2.7.2 Photodetector types .....	34
2.8 Optical fiber sensors .....	35
2.8.1 Optical fiber sensor components.....	37
2.8.1.1 Optical fiber sensor fibers .....	37
2.8.1.2 Optical fiber sensor sources .....	39
2.8.1.3 Optical fiber sensor detectors .....	39

### **Chapter three: Experimental work**

3.1 Introduction .....	41
3.2 Optical fiber current sensor.....	41
3.2.1 Readout of optical fiber current sensor configuration.....	43
3.2.2 Performance of optical fiber current sensor .....	46
3.3 Experimental setup and equipments.....	46
3.3.1 Laser light source.....	47
3.3.2 Polarizer .....	47
3.3.3 Optical fiber and its accessories .....	48
3.3.4 Beam splitter .....	48
3.3.5 Photomultiplier.....	49
3.3.6 Electrical current source.....	50
3.4 Experimental procedures .....	51
3.4.1 The first sensor configuration .....	51
3.4.2 Second sensor configuration .....	52
3.4.3 The third sensor configuration.....	52

### **Chapter four: Results and discussion**

4.1 First configuration results.....	54
4.2 Second configuration results.....	58
4.3 The third configuration results .....	62

4.4 Conclusions.....	66
4.5 Future work .....	67
References.....	69