

Table of Contents

Title Page	<i>i</i>
Abstract	<i>ii</i>
Acknowledgements	<i>iii</i>
Table of Contents	<i>v</i>
List of Illustrations	<i>vii</i>
Chapter 1: Introduction	1
1.1 The Role of Sapphire Fiber in Fiber Optic Sensors.....	1
1.2 Sapphire Fiber and Rod Based Optical Sensors.....	4
1.3 Preview of Thesis.....	14
Chapter 2: Sapphire Optical Fiber	16
2.1 The Growth of Sapphire Fiber.....	17
2.2 Optical and Mechanical Characteristics of Single-Crystal Sapphire Fiber.....	21
2.3 Cladding and Coating Sapphire Fiber.....	27
Chapter 3: White-Light Michelson Interferometry With Optical Fibers	31
3.1 Theoretical Description of the Bulk Optic Michelson Interferometer.....	33
3.2 Spatial and Temporal Coherence.....	38
3.3 Theoretical Output of a Michelson Interferometer with Laser Diode Source.....	45
3.4 Mode Orthogonality and Coupling in Optical Fibers.....	48
3.5 White-Light Michelson Interferometry Using Singlemode Optical Fibers.....	56
Chapter 4: The WSFMI with a Sapphire Fiber Sensing Head	60
4.1 The Use of a Silica Graded-Index Multimode Sensing Head in the WSFMI System.....	61
4.2 Initial Experiment with a Multimode Sapphire Fiber Sensing Head in the WSFMI System and Subsequent Improvements to the WSFMI System.....	67
4.2.1 Limitation of the Number of Excited Modes in the Sapphire Fiber.....	70
4.2.2 The Impact of Polarization Mode Fading.....	76
4.2.3 Modifications Made to the WSFMI System.....	78
4.3 Experimental Results.....	82
4.3.1 System Alignment and Component Specifications.....	83
4.3.2 Room Temperature Test.....	85

4.3.3 High Temperature Test 1.....	91
4.3.4 High Temperature Test 2.....	94
4.3.5 High Temperature Test 3.....	98
4.3.6 Use of the Modified WSFMI System to support the Implementation of the Sapphire Fiber Extrinsic Fabry-Perot Interferometric Sensor.....	101
4.4 Discussion.....	104
Chapter 5: Suggestions for Future Work.....	108
Conclusions.....	111
References.....	112
Vita.....	119