



Contents

Abstract	i
Table of contents	v
Formula signs and abbreviations	viii
1 Introduction	1
2 Brillouin scattering in optical fibers	3
2.1 Spontaneous and stimulated Brillouin scattering	3
2.2 The Brillouin gain spectrum	9
2.3 Brillouin threshold	11
3 Propagation of light in POF	12
3.1 Perfluorinated graded-index POF	12
3.2 Propagation of light in multimode fibers	15
3.3 Brillouin scattering in PFGI-POF	18
4 Coupling between silica fibers and PFGI-POF	23
4.1 Analytical description of coupling	24
4.2 Coupling based on lenses	31
4.3 Physical contact coupling	32
5 Distributed Brillouin sensors	36
5.1 Brillouin optical time-domain approach	37
5.2 Brillouin optical correlation-domain approach	38
5.3 Brillouin optical frequency-domain approach	39
5.4 Brillouin sensing in POF	43



6	Sensory analysis of SBS in PFGI-POF	46
6.1	Measurement setup	46
6.2	Determination of the BFS	49
6.3	Pump threshold in PFGI-POF	50
6.4	Temperature, humidity and strain influence on the BFS	54
6.5	Analytical description of impacts	56
6.6	Influence of temperature and humidity on the BGS	58
6.7	Origin of the humidity-induced BFS	59
7	Frequency uncertainty in Brillouin sensors	64
7.1	Description of the model	65
7.2	Frequency uncertainties in distributed measurements	70
7.3	Figure-of-merit for BOFDA	73
8	Designing a distributed Brillouin sensor in PFGI-POF	74
8.1	The big picture	75
8.2	Fiber transfer function	77
8.3	Optical filtering	80
8.4	Experimental BOFDA results in POF	85
9	Summary and Outlook	90
	Bibliography	95