Design of PCF with Highly Birefringence

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INTRODUCTION:

- Photonic crystal fiber (PCF) is a kind of optical fiber that uses photonic crystals to form the cladding around the core of the cable.
- Photonic crystal is a low-loss periodic dielectric medium constructed using a periodic array of microscopic air holes that run along the entire fiber length.
- Birefringence is the optical property of a material having a refractive index that depends on the polarization and propagation direction of light.

METHODOLOGY:

- PCF with five ring of air-holes in which the centre row is enlarged in size is proposed to obtain a fiber with high birefringent.
- The flow chart of the work is shown in Figure 1.

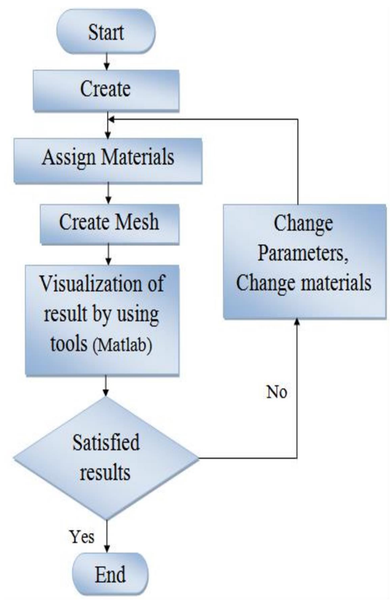


Figure1. Flow chart

- The Birefringence is calculated by using this formula:

$$B = |\,\mathrm{Re}\left(n_{eff}^{x} - n_{eff}^{y}\right)|$$

- The geometry of the proposed design is shown in Figure 2.

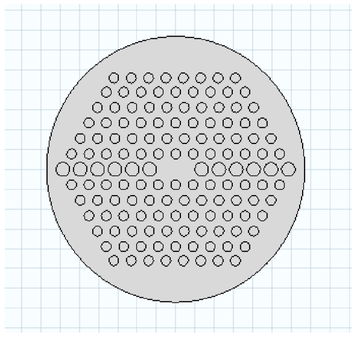
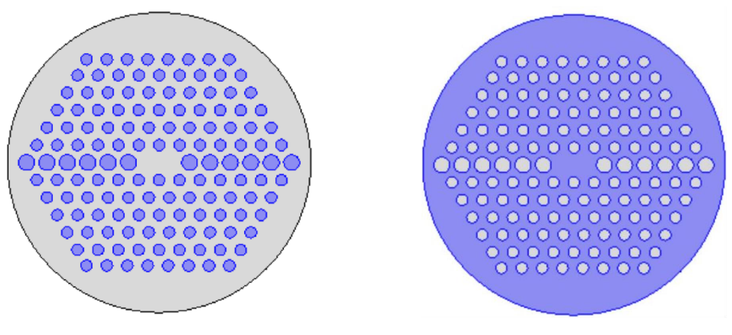


Figure 2. Proposed Geometry

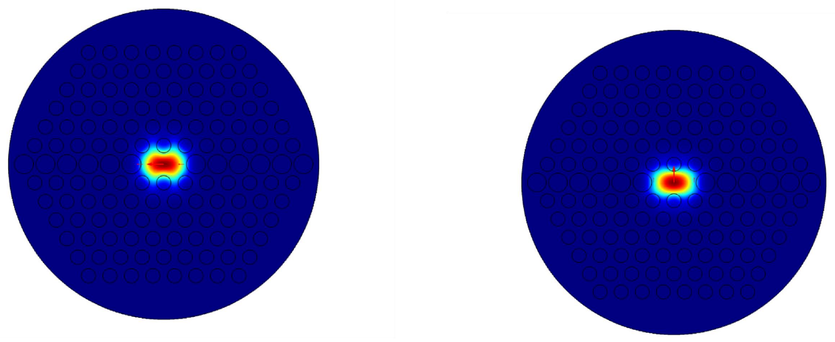
- The proposed geometry with various medium is shown in Figure 3.



(a) **(b)**

Figure 3. Proposed geometry with (a) Air and (b) Silica glass

- Effective Index of X-Polarization and Effective Index of Y-Polarization is shown in Figure 4.



(a) (b)

Figure 4. Effective Index of (a) X-Polarization (b)Y-Polarization

RESULTS:

- This proposed PCF design has very good birefringence value of 2.1×10^{-3} at λ=1.3μm, 3.25×10^{-3} at λ=1.5 μm, for r = 0.6 μm and R = 0.8 μm .

Pitch (Λ=1.8μm)	Radius(r, R)	Wavelength(μm)				
		1.3	1.4	1.5	1.6	1.7
	r =0.7,R=0.9	0.001966	0.002339	0.002738	0.00316	0.004055
	r =0.5,R=0.7	0.000609	0.000708	0.000906	0.001089	0.001305
	r =0.6,R=0.8	0.00219	0.000349	0.00325	0.000385	0.000375
	r =0.8,R=0.9	0.000992	0.001161	0.001337	0.001515	0.001866
	r =0.7,R=0.8	0.000839	0.000991	0.00115	0.001313	0.001646

Table 1. Birefringence vs wavelength for different radius

- Figure 7(a) and 7(b) represents the graph of Effective Index vs Wavelength.
- Figure 8(a) and 8(b) represents the graph of Birefringence vs Wavelength.

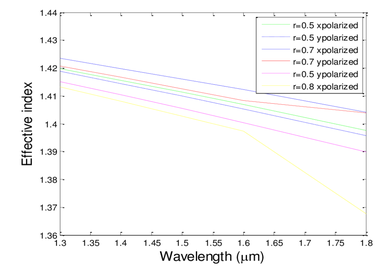


Figure 7(a).
Effective Index vs Wavelength
(R is constant)

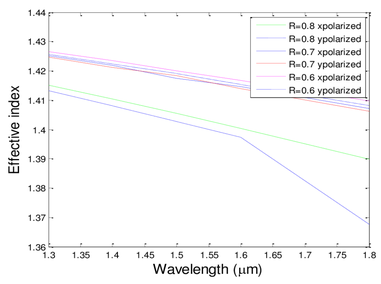


Figure 7(b).
Effective Index vs Wavelength
(r is constant)

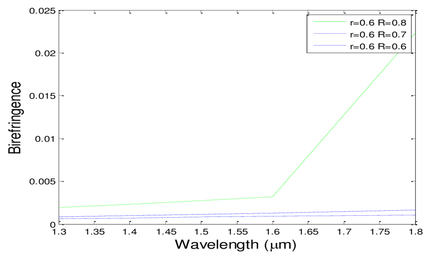


Figure 8(a).
Birefringence vs Wavelength
(R is constant)

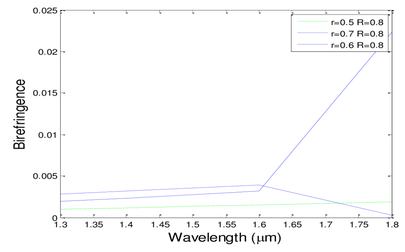


Figure8(b).
Birefringence vs Wavelength
(r is constant)

CONCLUSIONS:

- For silica glass based OFC, the PCF with air holes of r=0.6 and R=0.8 is proposed.
- For this proposed design the highest birefringence values of 3.325×10^{-3} (at λ=1.5μm) and 2.13×10^{-3} (at λ=1.3μm) are obtained.

REFERENCES:

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