Two Hole Fiber (THF)

Report date

May 9, 2026, 2:43:31 PM

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1 Global Definitions

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GLOBAL SETTINGS

Unit system	SI

USED PRODUCTS

COMSOL Multiphysics
Structural Mechanics Module
Wave Optics Module

1.1 PARAMETERS

PARAMETERS 1

Name	Expression	Value	Description
nSiO2	1.44471	1.4447	Refractive index, silica (SiO2)
nCore	1.45001	1.45	Relative index difference
nWater	1.31056	1.3106	Refractive index, core (doped SiO2)
B1	0.65e-12[m^2/N]	6.5E−13 1/Pa	First stress optical coefficient
B2	4.2e-12[m^2/N]	4.2E−12 1/Pa	Second stress optical coefficient
T1	80[degC]	353.15 K	Operating temperature
T0	20[degC]	293.15 K	Reference temperature
lambda0_ewfd	1.55[um]	1.55E−6 m	Free space wavelength
para	1	1	
CTEW	640e-6	6.4E−4	
EW	2.2e9	2.2E9	
nSiO22	1.44405	1.4441	Refractive index, silica (SiO2)
nCore2	1.44935	1.4494	Relative index difference
nWater2	1.3175	1.3175	Refractive index, core (doped SiO2)
B12	0.65e-12[m^2/N]	6.5E−13 1/Pa	First stress optical coefficient
B22	4.2e-12[m^2/N]	4.2E−12 1/Pa	Second stress optical coefficient
T12	24[degC]	297.15 K	Operating temperature
T02	23.85[degC]	297 K	Reference temperature
CTEW2	255e-6	2.55E−4	
EW2	2.22e9	2.22E9	

2 Component 1

SETTINGS

Description	Value
Unit system	Same as global system (SI)
Geometry shape function	Automatic
Avoid inverted elements by curving interior domain elements	Off

SPATIAL FRAME COORDINATES

First	Second	Third
x	y	z

MATERIAL FRAME COORDINATES

First	Second	Third
X	Y	Z

GEOMETRY FRAME COORDINATES

First	Second	Third
Xg	Yg	Zg

MESH FRAME COORDINATES

First	Second	Third
Xm	Ym	Zm

2.1 DEFINITIONS

2.1.1 Variables

Variables 1

SELECTION

Geometric entity level	Domain
Selection	Geometry geom1: Dimension 2: Domain 3

Name	Expression	Unit	Description
N	nCore		
N2	nCore2		

Variables 2

SELECTION

Geometric entity level	Domain
Selection	Geometry geom1: Dimension 2: Domains 2, 4

Name	Expression	Unit	Description
N	nWater		
N2	nWater2		

Variables 3

SELECTION

Geometric entity level	Domain
Selection	Geometry geom1: Dimension 2: Domain 1

Name	Expression	Unit	Description
N	nSiO2		
N2	nSiO22		

Variables 4

SELECTION

Geometric entity level	Domain
Selection	Geometry geom1: Dimension 2: Domains 1–4

Name	Expression	Unit	Description
Nx	N - 1*(B1*solid.sx + B2*(solid.sy + solid.sz))		
Ny	N - 1*(B1*solid.sy + B2*(solid.sx + solid.sz))		
Nz	N - 1*(B1*solid.sz + B2*(solid.sx + solid.sy))		
Nxx	N2 - 1*(B12*solid2.sx + B22*(solid2.sy + solid2.sz))		
Nyy	N2 - 1*(B12*solid2.sy + B22*(solid2.sx + solid2.sz))		
Nzz	N2 - 1*(B12*solid2.sz + B22*(solid2.sx + solid2.sy))		

2.1.2 Coordinate Systems

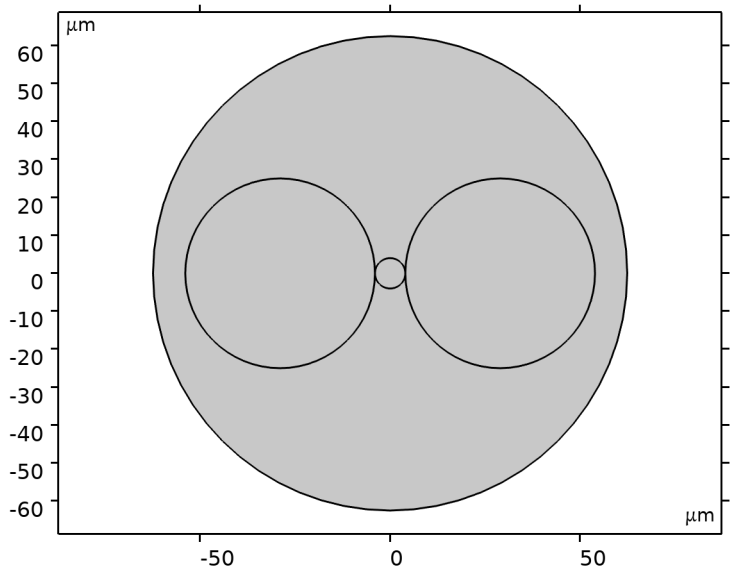
Boundary System 1

Coordinate system type	Boundary system
Tag	sys1

COORDINATE NAMES

First	Second	Third
t1	n	to

2.2 GEOMETRY 1



Geometry 1

UNITS

Length unit	µm
Angular unit	deg

2.2.1 Cladding (c1)

SIZE AND SHAPE

Description	Value
Radius	62.5

POSITION

Description	Value
Position	{0, 0}

2.2.2 Nucleo (c3)

SIZE AND SHAPE

Description	Value
Radius	4

POSITION

Description	Value
Position	{0, 0}

2.2.3 Hueco_1 (c2)

SIZE AND SHAPE

Description	Value
Radius	25

POSITION

Description	Value
Position	{-29, 0}

2.2.4 Hueco_2 (c4)

SIZE AND SHAPE

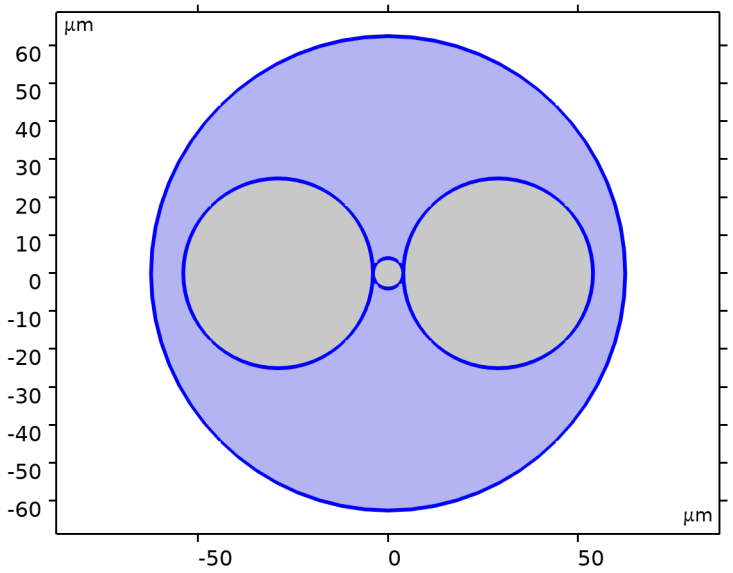
Description	Value
Radius	25

POSITION

Description	Value
Position	{29, 0}

2.3 MATERIALS

2.3.1 Corning 7940 (fused silica) [solid,10 mm]



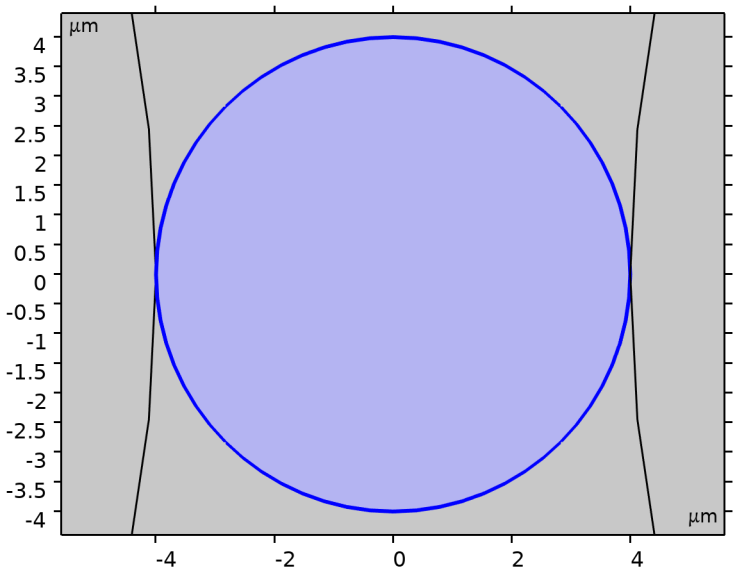
Corning 7940 (fused silica) [solid,10 mm]

SELECTION

Geometric entity level	Domain

Selection	Geometry geom1: Dimension 2: Domain 1

2.3.2 Corning 7940 (fused silica) [solid,10 mm] 1

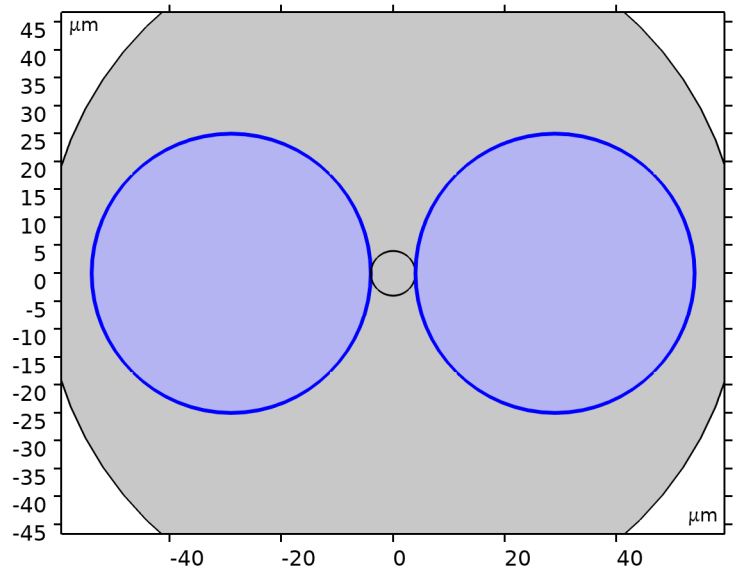


Corning 7940 (fused silica) [solid,10 mm] 1

SELECTION

Geometric entity level	Domain
Selection	Geometry geom1: Dimension 2: Domain 3

2.3.3 Water

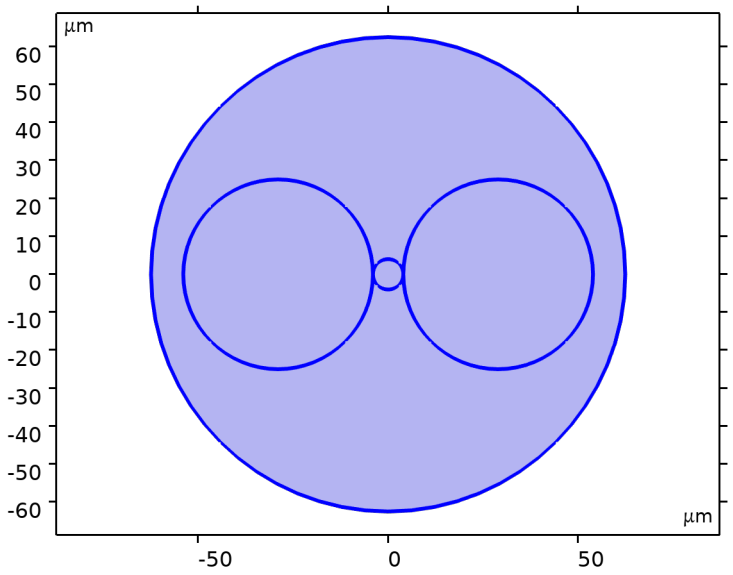


Water

SELECTION

Geometric entity level	Domain
Selection	Geometry geom1: Dimension 2: Domains 2, 4

2.4 SOLID MECHANICS



Solid Mechanics

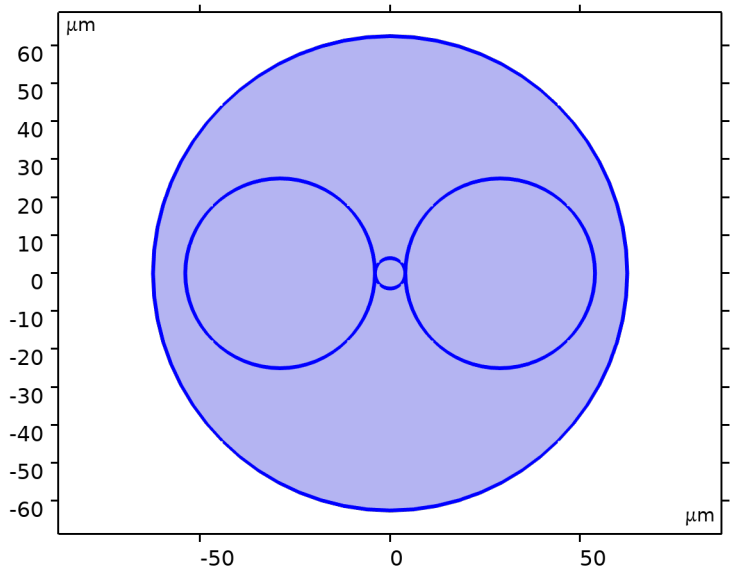
EQUATIONS

$$0 = \nabla \cdot S + \mathbf{f}_V$$

FEATURES

Name	Level
Linear Elastic Material 1	Domain
Free 1	Boundary
Initial Values 1	Domain
Linear Elastic Material 2	Domain

2.5 SOLID MECHANICS 2



Solid Mechanics 2

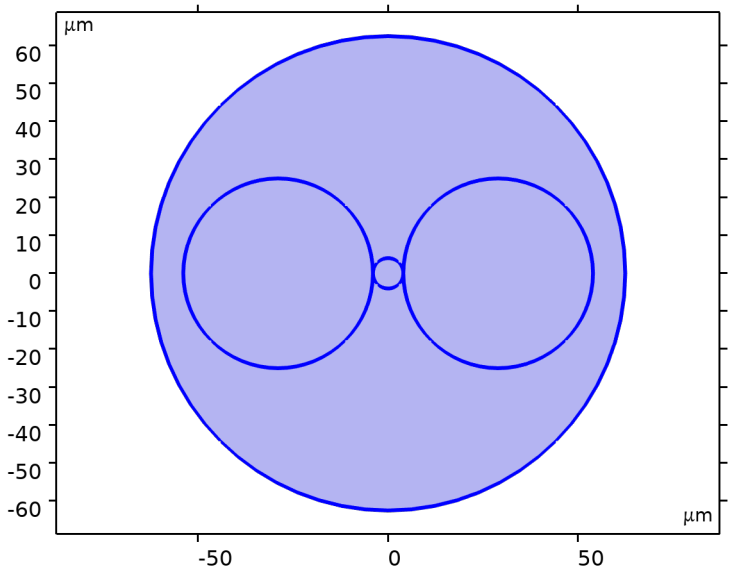
EQUATIONS

$$0 = \nabla \cdot S + \mathbf{f}_V$$

FEATURES

Name	Level
Linear Elastic Material 1	Domain
Free 1	Boundary
Initial Values 1	Domain
Linear Elastic Material 2	Domain

2.6 ELECTROMAGNETIC WAVES, FREQUENCY DOMAIN



Electromagnetic Waves, Frequency Domain

EQUATIONS

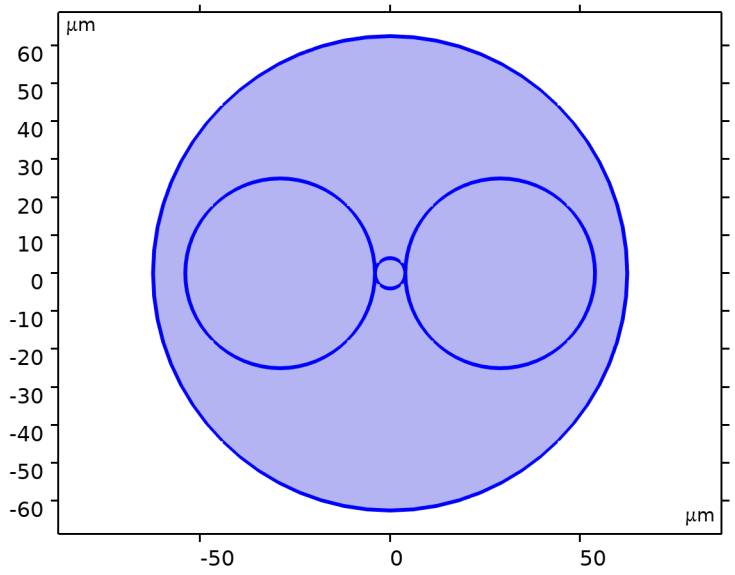
$$\nabla \times \mu_r^{-1}(\nabla \times \mathbf{E}) - k_0^2(\epsilon_r - \frac{j\sigma}{\omega\epsilon_0})\mathbf{E} = \mathbf{0}$$

$$\mathbf{E}(x,y,z) = \tilde{\mathbf{E}}(x,y)e^{-ik_z z}$$

FEATURES

Name	Level
Wave Equation, Electric 1	Domain
Perfect Electric Conductor 1	Boundary
Initial Values 1	Domain

2.7 ELECTROMAGNETIC WAVES, FREQUENCY DOMAIN 2



Electromagnetic Waves, Frequency Domain 2

EQUATIONS

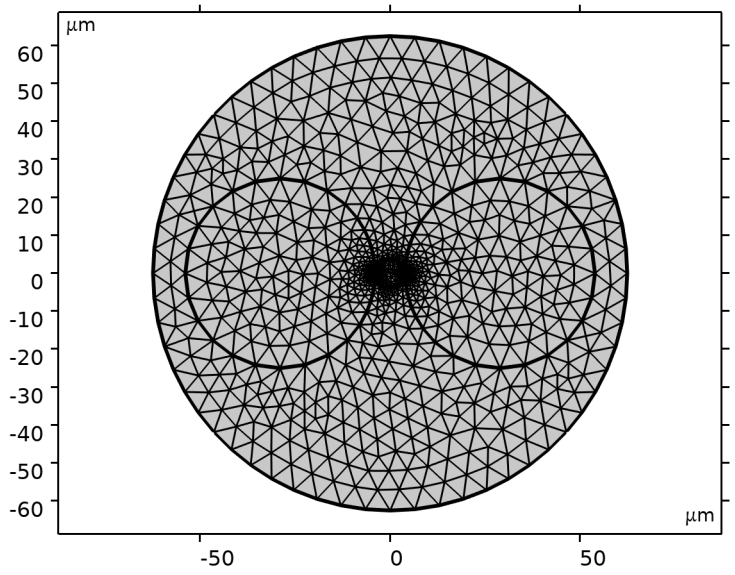
$$\nabla \times \mu_r^{-1}(\nabla \times \mathbf{E}) - k_0^2(\epsilon_r - \frac{j\sigma}{\omega\epsilon_0})\mathbf{E} = \mathbf{0}$$

$$\mathbf{E}(x,y,z) = \tilde{\mathbf{E}}(x,y)e^{-ik_z z}$$

FEATURES

Name	Level
Wave Equation, Electric 1	Domain
Perfect Electric Conductor 1	Boundary
Initial Values 1	Domain

2.8 MESH 1



Mesh 1

2.8.1 Size (size)

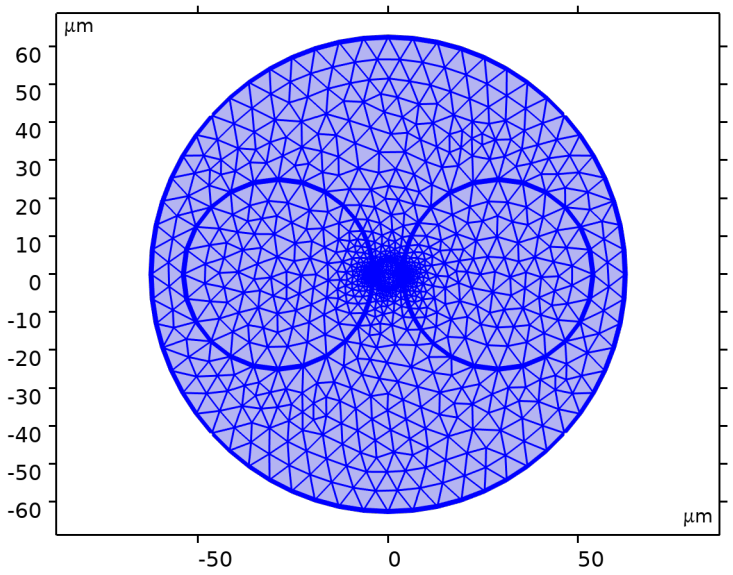
SETTINGS

Description	Value
Maximum element size	6.63
Minimum element size	0.0375
Curvature factor	0.3
Maximum element growth rate	1.3
Predefined size	Fine

2.8.2 Free Triangular 1 (ftri1)

SELECTION

Geometric entity level	Domain
Selection	Remaining



Free Triangular 1

INFORMATION

Description	Value
Last build time	Unknown

3 Study 1

COMPUTATION INFORMATION

Computation time	56 s

3.1 PARAMETRIC SWEEP

Parameter name	Parameter value list
para	1

STUDY SETTINGS

Description	Value
Sweep type	Specified combinations
Parameter name	para

PARAMETERS

Parameter name	Parameter value list	Parameter unit
para	1	

3.2 STATIONARY

STUDY SETTINGS

Description	Value
Include geometric nonlinearity	Off

STUDY SETTINGS

Description	Value
Tolerance	User controlled
Relative tolerance	5

PHYSICS AND VARIABLES SELECTION

Key	Solve for
Solid Mechanics (solid)	On
Solid Mechanics 2 (solid2)	On
Electromagnetic Waves, Frequency Domain (ewfd)	Off
Electromagnetic Waves, Frequency Domain 2 (ewfd2)	Off

STORE IN OUTPUT

Interface	Output	Selection
Solid Mechanics (solid)	Physics controlled	
Solid Mechanics 2 (solid2)	Physics controlled	

Interface	Output	Selection
Electromagnetic Waves, Frequency Domain (ewfd)	Physics controlled	
Electromagnetic Waves, Frequency Domain 2 (ewfd2)	Physics controlled	

MESH SELECTION

Component	Mesh
Component 1	Mesh 1

3.3 MODE ANALYSIS

STUDY SETTINGS

Description	Value
Include geometric nonlinearity	Off

STUDY SETTINGS

Description	Value
Transform	Effective mode index
Mode analysis frequency	c_const/lambda0_ewfd
Desired number of modes	80
Desired number of modes	On
Unit	
Search for modes around shift	1.45
Search for modes around shift	On

VALUES OF LINEARIZATION POINT

Description	Value
Settings	User controlled
Method	Solution
Study	Study 1

PHYSICS AND VARIABLES SELECTION

Key	Solve for
Solid Mechanics (solid)	Off
Solid Mechanics 2 (solid2)	Off
Electromagnetic Waves, Frequency Domain (ewfd)	On
Electromagnetic Waves, Frequency Domain 2 (ewfd2)	Off

STORE IN OUTPUT

Interface	Output	Selection
Solid Mechanics (solid)	Physics controlled	

Interface	Output	Selection
Solid Mechanics 2 (solid2)	Physics controlled	
Electromagnetic Waves, Frequency Domain (ewfd)	Physics controlled	
Electromagnetic Waves, Frequency Domain 2 (ewfd2)	Physics controlled	

MESH SELECTION

Component	Mesh
Component 1	Mesh 1

SETTINGS

Description	Value
Sort based on transformed eigenvalues	Off

4 Study 2

COMPUTATION INFORMATION

Computation time	25 s

4.1 MODE ANALYSIS

STUDY SETTINGS

Description	Value
Include geometric nonlinearity	Off

STUDY SETTINGS

Description	Value
Transform	Effective mode index
Mode analysis frequency	c_const/1.55[um]
Desired number of modes	40
Desired number of modes	On
Unit	
Search for modes around shift	1.45
Search for modes around shift	On

PHYSICS AND VARIABLES SELECTION

Key	Solve for
Solid Mechanics (solid)	Off
Solid Mechanics 2 (solid2)	Off
Electromagnetic Waves, Frequency Domain (ewfd)	Off
Electromagnetic Waves, Frequency Domain 2 (ewfd2)	On

STORE IN OUTPUT

Interface	Output	Selection
Solid Mechanics (solid)	Physics controlled	
Solid Mechanics 2 (solid2)	Physics controlled	
Electromagnetic Waves, Frequency Domain (ewfd)	Physics controlled	
Electromagnetic Waves, Frequency Domain 2 (ewfd2)	Physics controlled	

MESH SELECTION

Component	Mesh
Component 1	Mesh 1

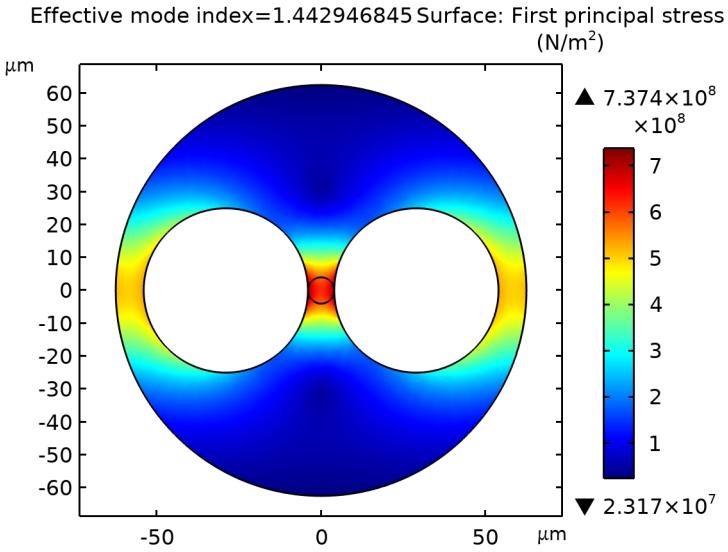
SETTINGS

Description	Value
Sort based on transformed eigenvalues	Off

5 Results

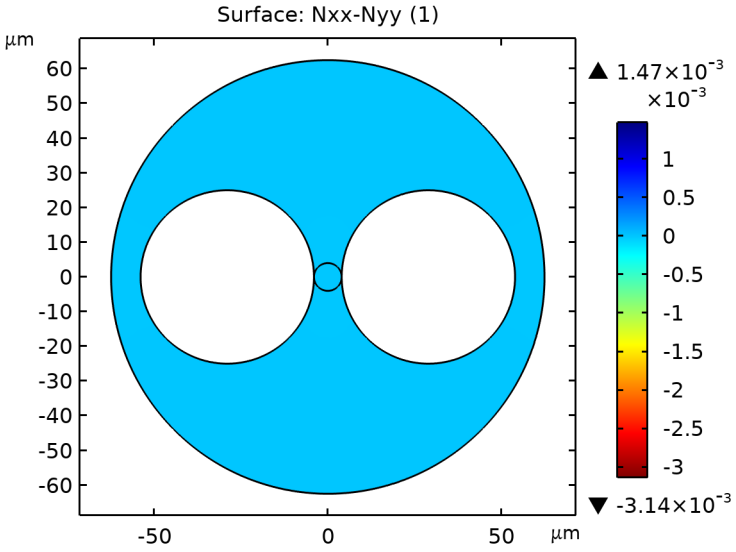
5.1 PLOT GROUPS

5.1.1 First principal stress



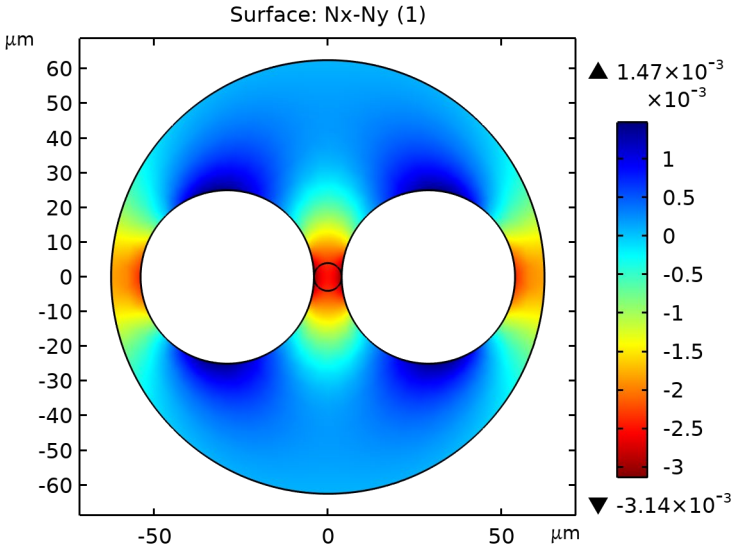
Surface: First principal stress (N/m²)

5.1.2 Birefringence 24°C



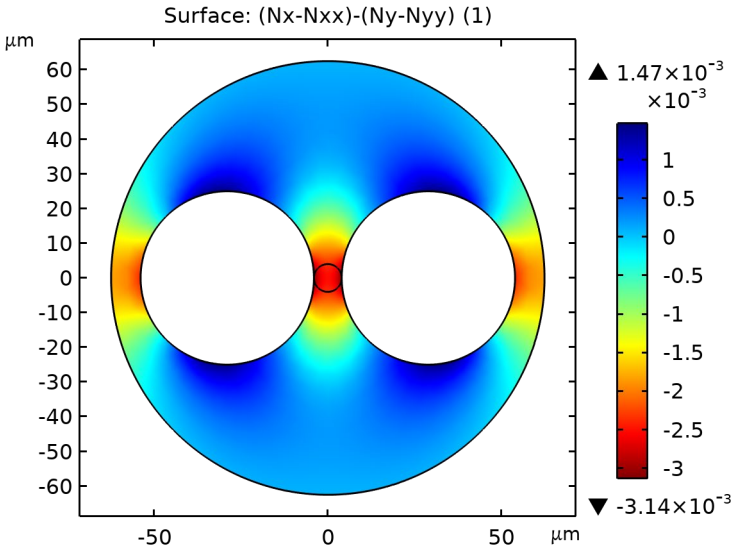
Surface: Nxx-Nyy (1)

5.1.3 Birefringence 80°C



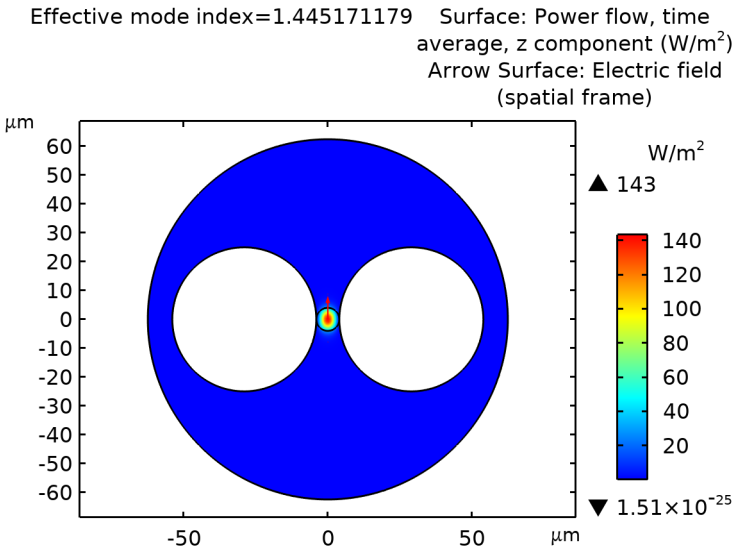
Surface: Nx-Ny (1)

5.1.4 Birefringence 24°C to 80°C



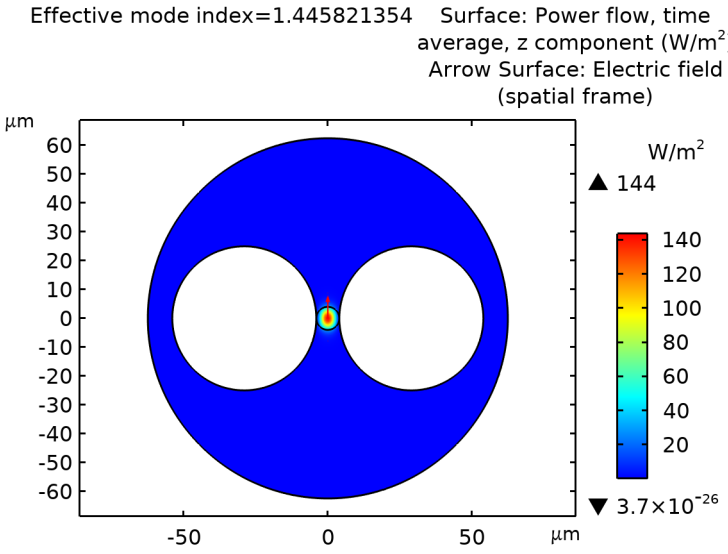
Surface: (Nx-Nxx)-(Ny-Nyy) (1)

5.1.5 Electric Field (ewfd2)_ 24°C



Surface: Power flow, time average, z component (W/m²) Arrow Surface: Electric field (spatial frame)

5.1.6 Electric Field (ewfd)_80°C



Surface: Power flow, time average, z component (W/m²) Arrow Surface: Electric field (spatial frame)