



Electromagnetics:
Electromagnetic Field Theory
Other Waveguides

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Lecture Outline

- Double-Ridge Waveguides
- Cylindrical Waveguides
- Optical Waveguides and Components

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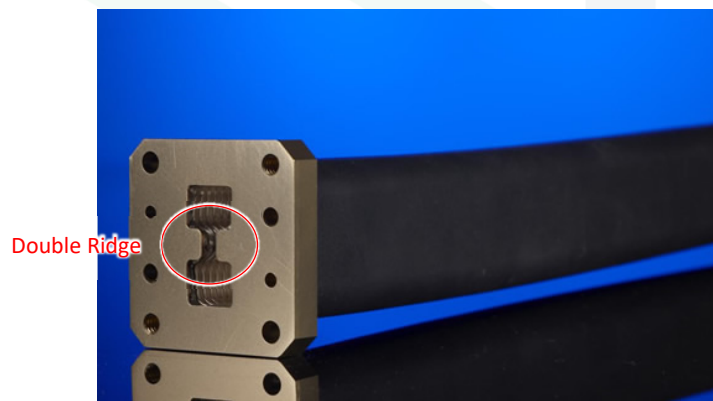
Double-Ridge Waveguides

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What is a Double-Ridge Waveguide?

Double-ridge waveguides are used like ordinary rectangular waveguides, but they have two ridges at opposite faces.



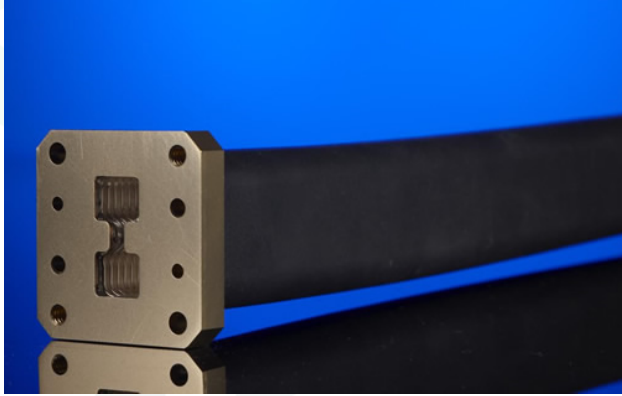
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Why?

They are single mode over a broader range of frequencies than a rectangular waveguide.

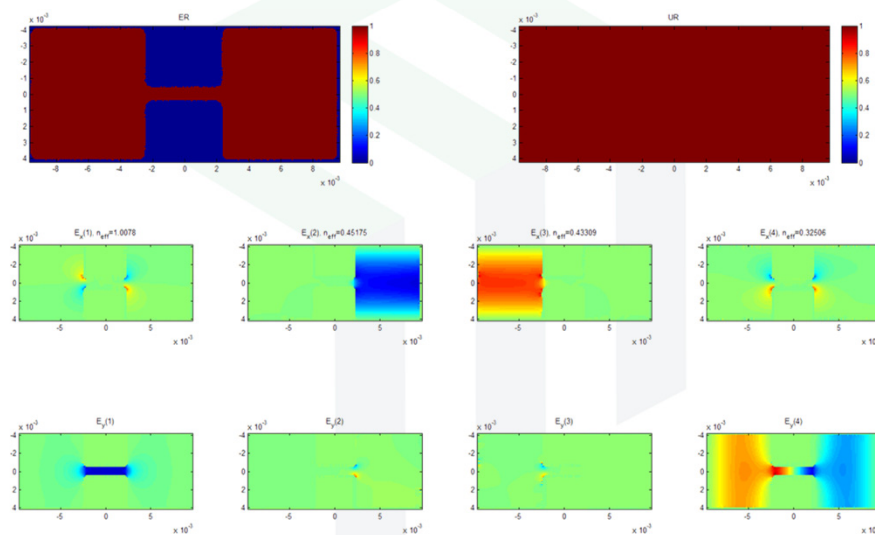
$$\begin{aligned} b &= 0.323'' \\ a &= 0.752'' \\ w &= 0.188'' \\ h &= 0.143'' \\ r &= 0.015'' \end{aligned}$$



The above waveguide operates single mode from 5.0 to 16.00 GHz. This has a 105% fractional bandwidth.

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Modes in a Double Ridge



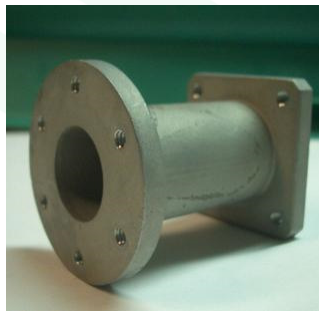
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Cylindrical Metal Waveguide

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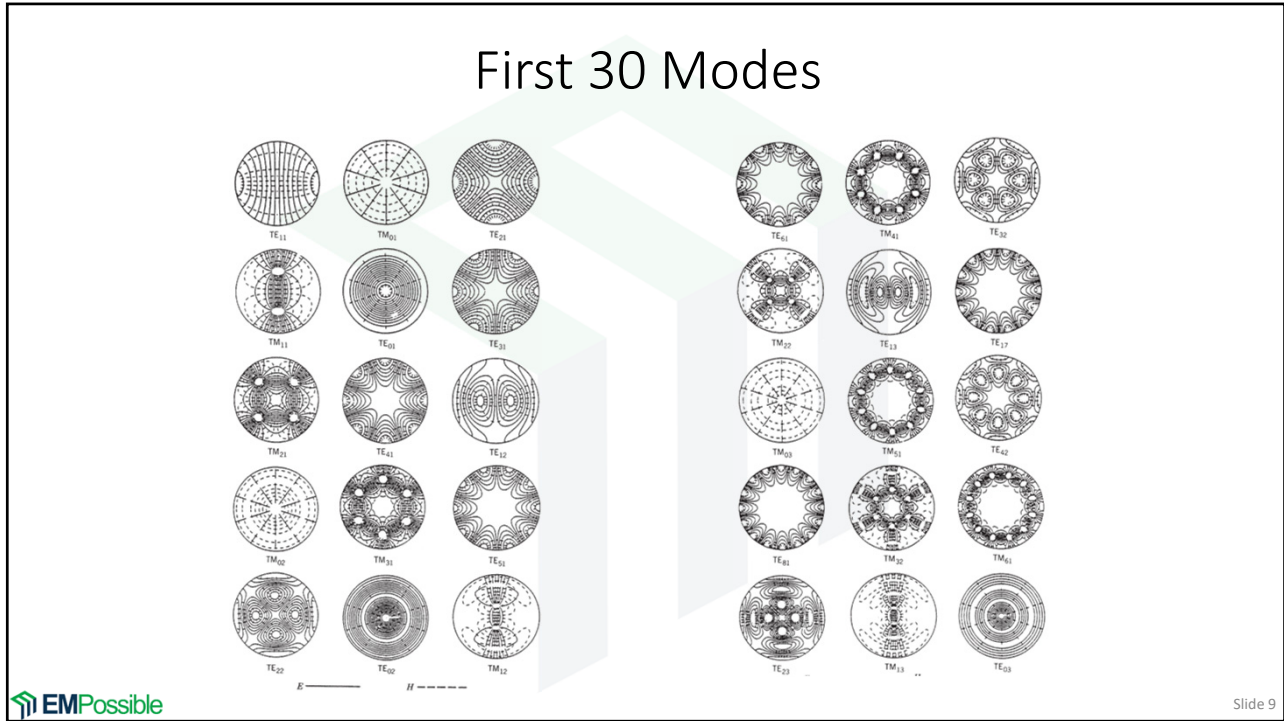
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The Cylindrical Metal Waveguide

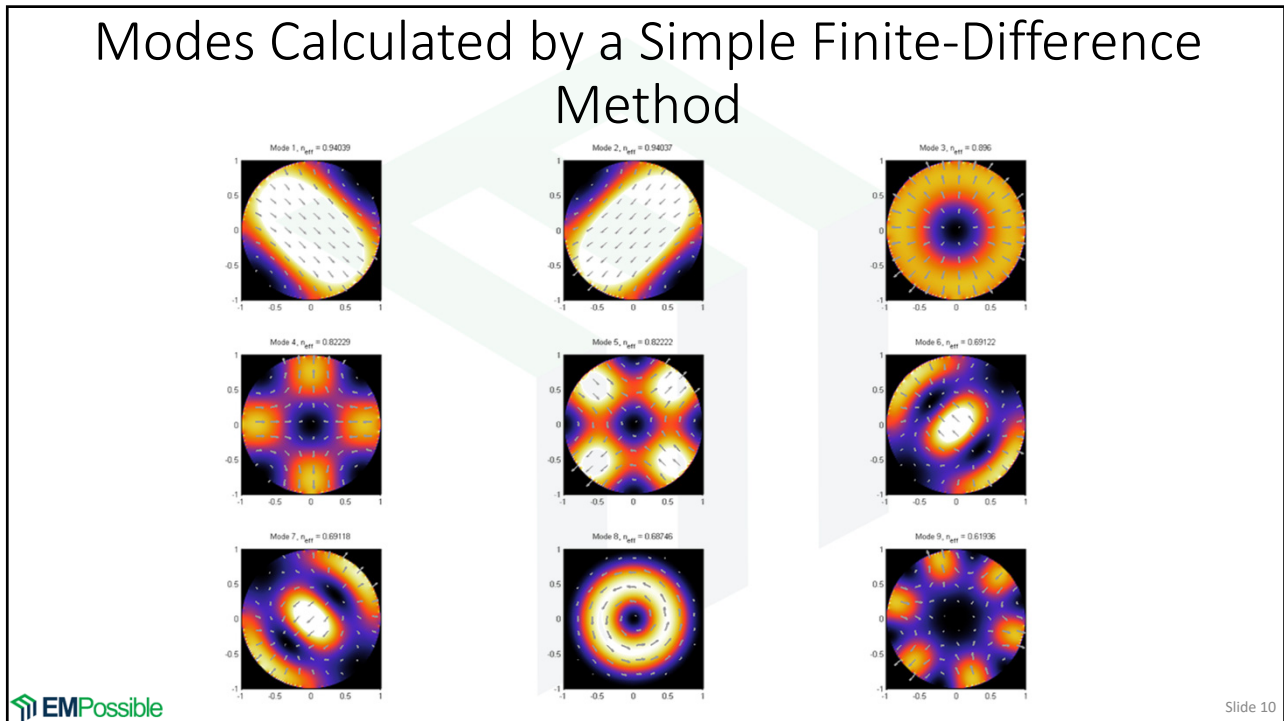


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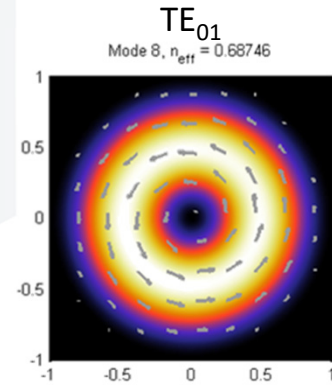
Waveguides for High Power

The ideal guided mode for high power in a metal waveguide has:

1. Zero amplitude at the surface of the metals.
2. Power distributed over as large of an area as possible.

To address #1, a mode is desired that has only tangential components at the surface of the metal.

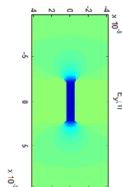
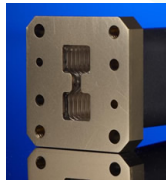
To address #2, large waveguides are preferred so the modes are spread out over larger areas.



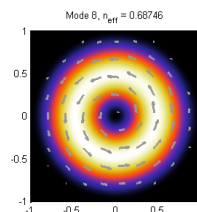
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What is a Good Waveguide for High Power?

Double ridge is a bad choice because the field is too concentrated.



The cylindrical waveguide is a good choice, but only for one special high order mode.



This is called an "over-moded" cylindrical waveguide.

TE_{01} is actually the 5th-order mode in this waveguide.

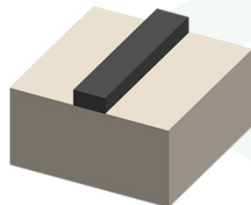
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Optical Waveguides and Components

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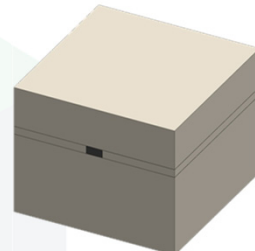
Conventional Optical Waveguides



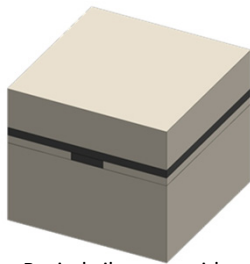
Stripe waveguide



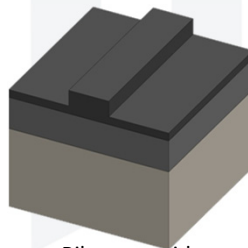
Diffused waveguide



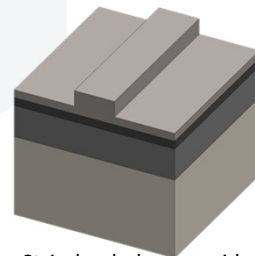
Buried-strip waveguide



Buried-rib waveguide



Rib waveguide

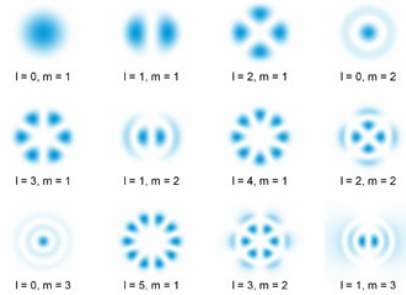
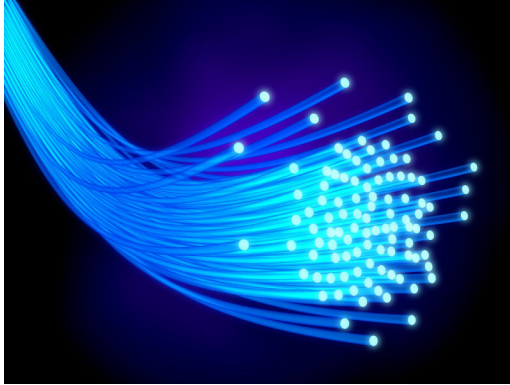


Strip-loaded waveguide

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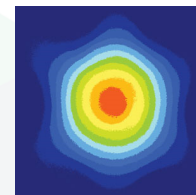
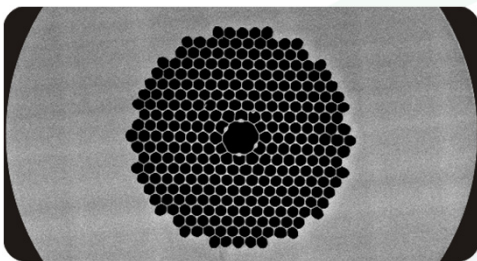
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Optical Fibers



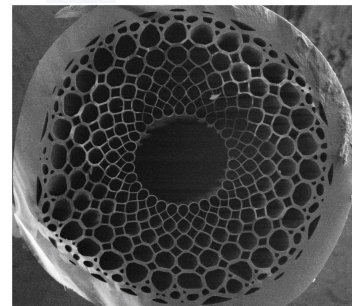
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Photonic Crystal Optical Fibers



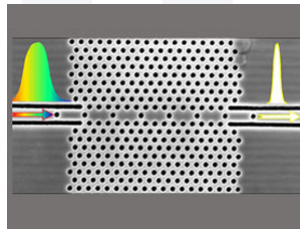
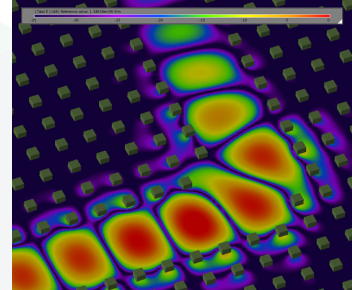
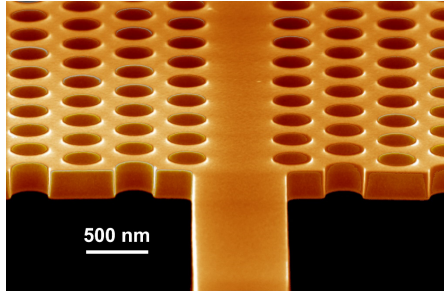
Photonic crystal fibers are typically used to control dispersion.

They can also distribute power for high power applications.



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Photonic Crystal Waveguides



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