
*Ripple-Wall Mode
Converters for High Power
Microwave Applications*

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Overview

- Purpose
- Simulation Approaches
- Results
- Future Plans
- Summary

Purpose

- Sometimes output modes from a source are different from the required modes for testing
- Gyroklystron: output signal has a TE_{02} mode pattern, but to run certain tests, different output modes are required

Optimization Techniques

Parameters

- Number of ripples (N)
- Average radius
- Ripple size
- Length of converter

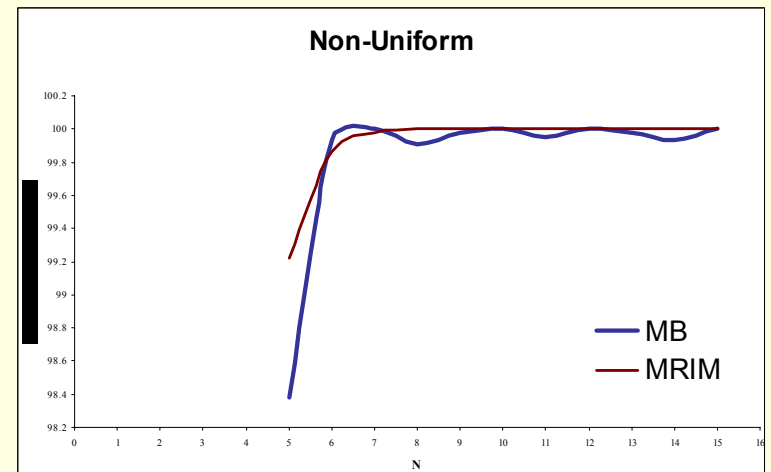
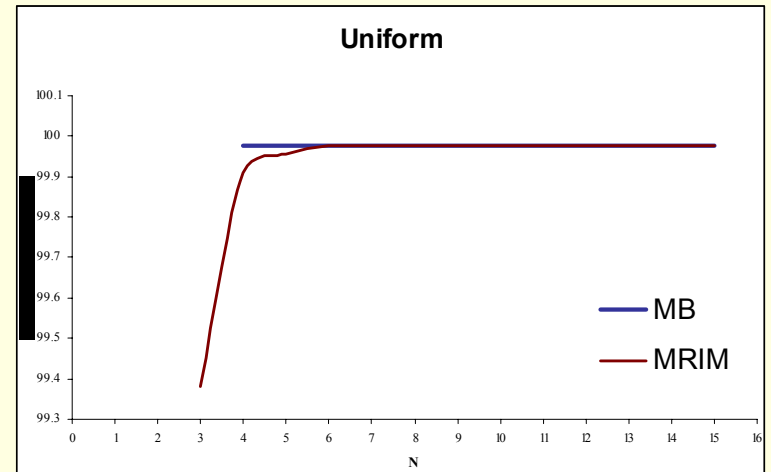
Methods

- Minimum Residual Incident Mode (MRIM)
-uses the optimum radius
- Maximum Bandwidth (MB)
-uses the maximum radius

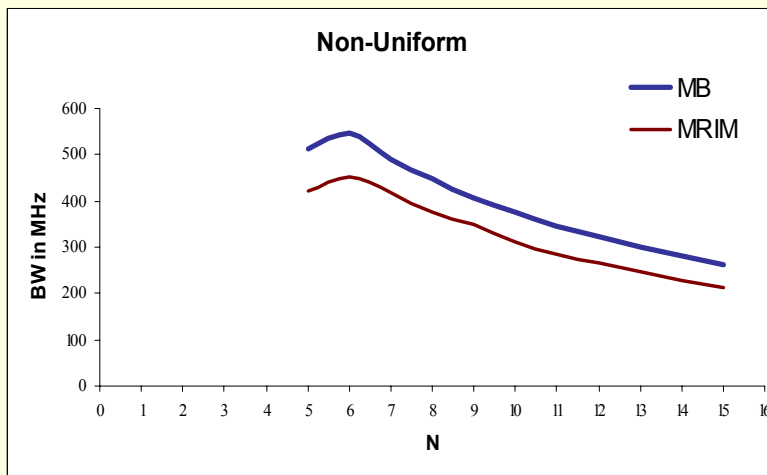
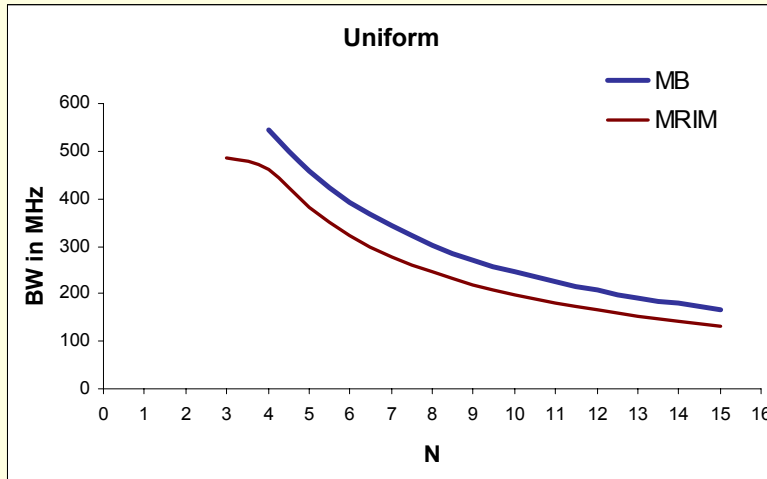
MRIM versus MB (Mode Conversion)

TE₀₁ → TE₀₂ Mode Conversion for Different Values of N

- For both designs, the MB and MRIM optimizations have increasing TE₀₂ mode conversion with increasing N
- Conversion stabilizes near 100% between 4-6 ripples



MRIM versus MB (Bandwidth)

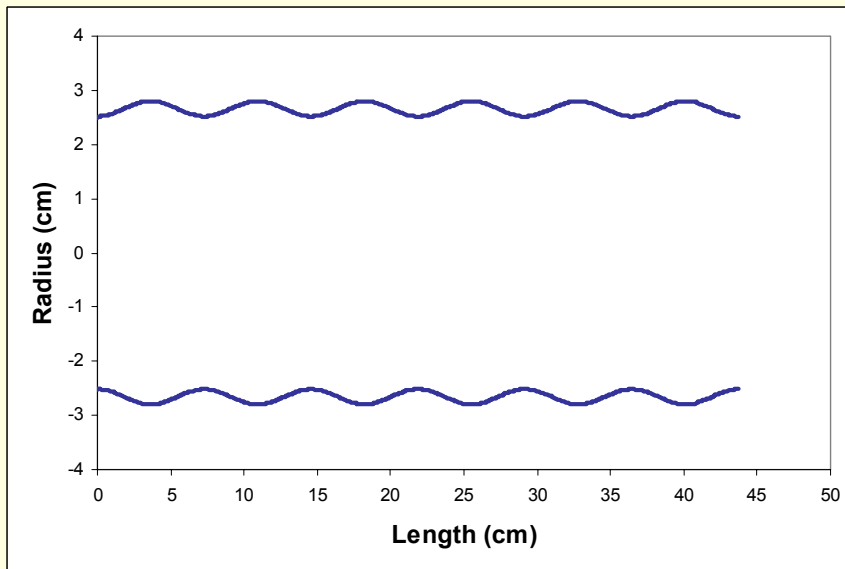


$TE_{01} \rightarrow TE_{02}$ Bandwidth for Different Values of N

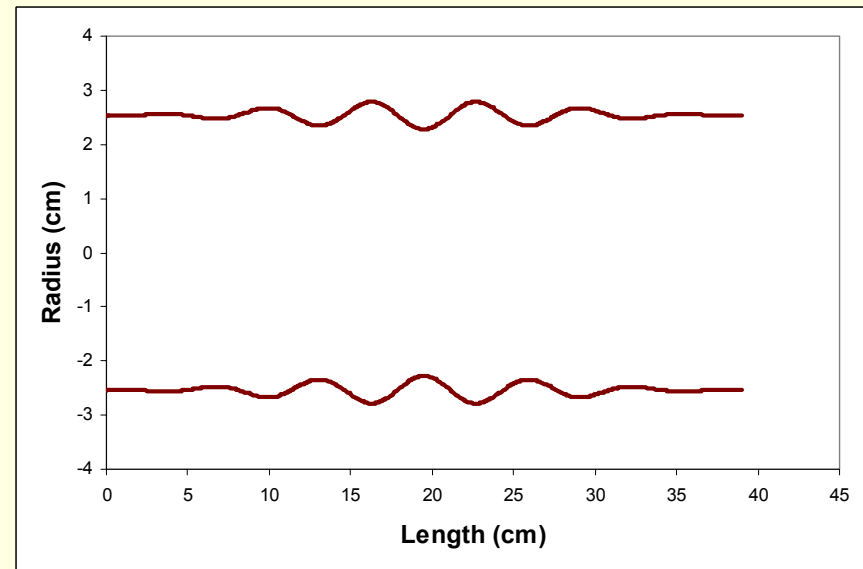
- Because bandwidth for the MB optimization is better, and mode conversion for each technique is comparable, this optimization was chosen as the superior method

Two Designs ($N = 6$)

Uniform Ripple
($TE_{01} \rightarrow TE_{02}$ MB converter)

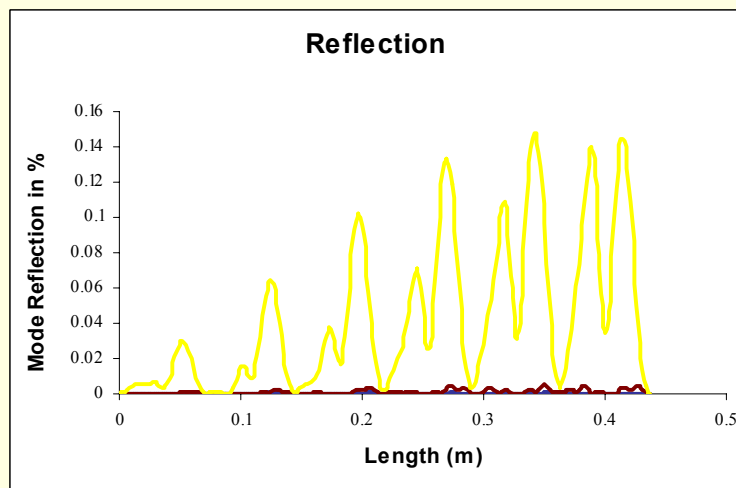
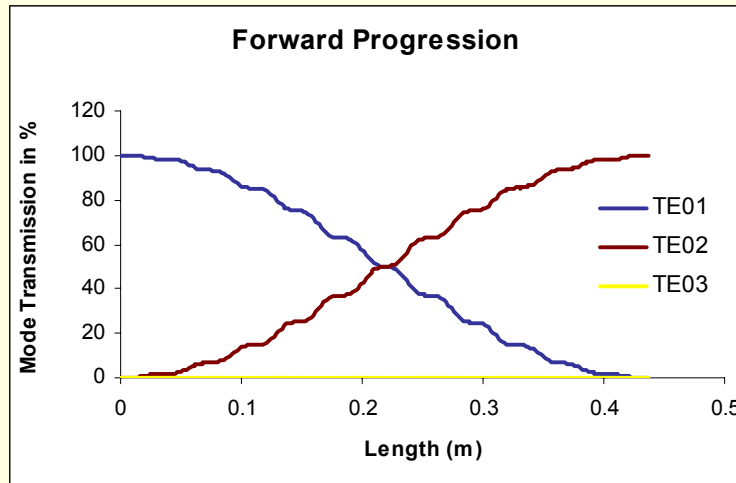


Non-Uniform Ripple
($TE_{01} \rightarrow TE_{02}$ MB converter)

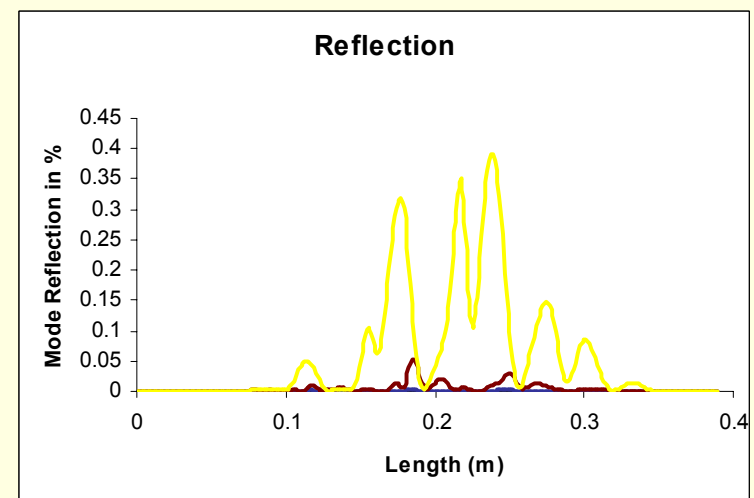
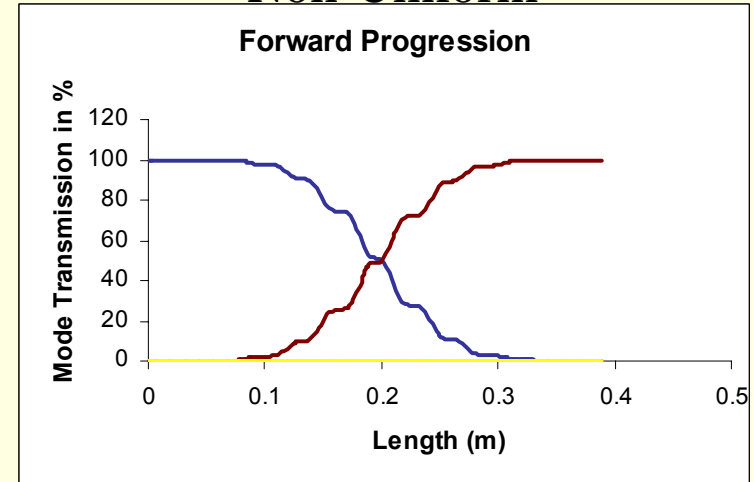


Spatial Mode Progression ($N = 6$ $TE_{01} \rightarrow TE_{02}$ MB Converters)

Uniform



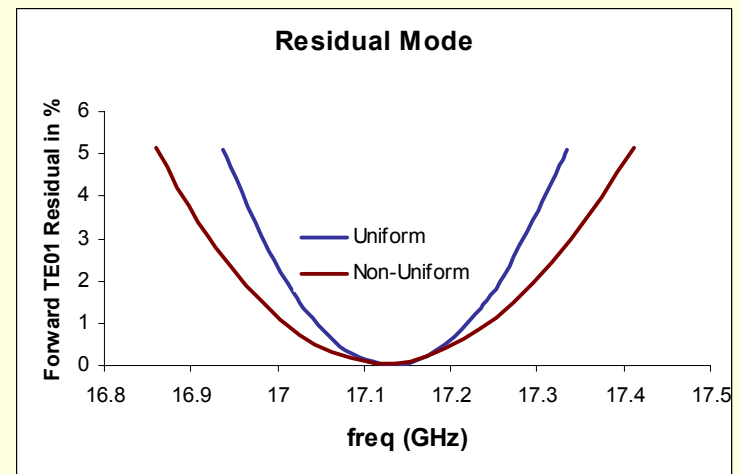
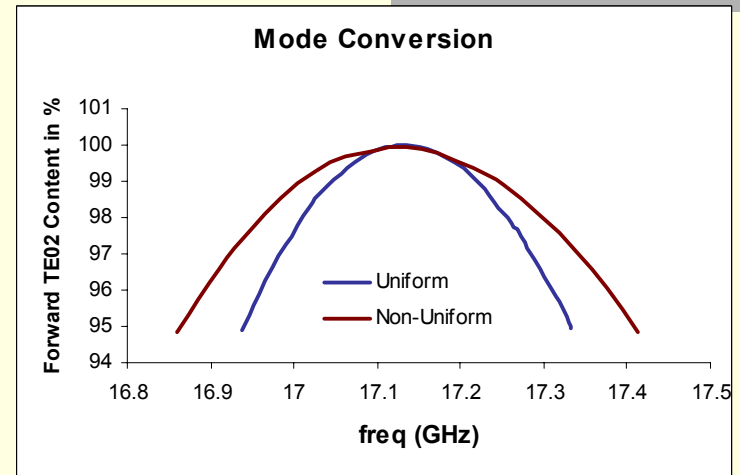
Non-Uniform



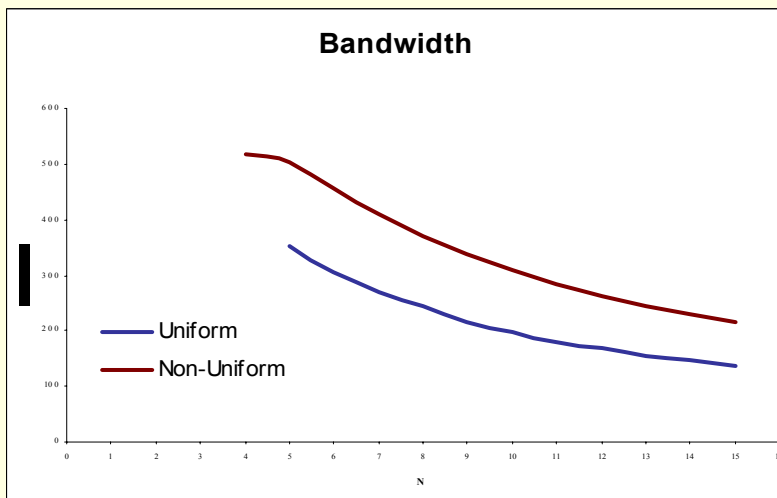
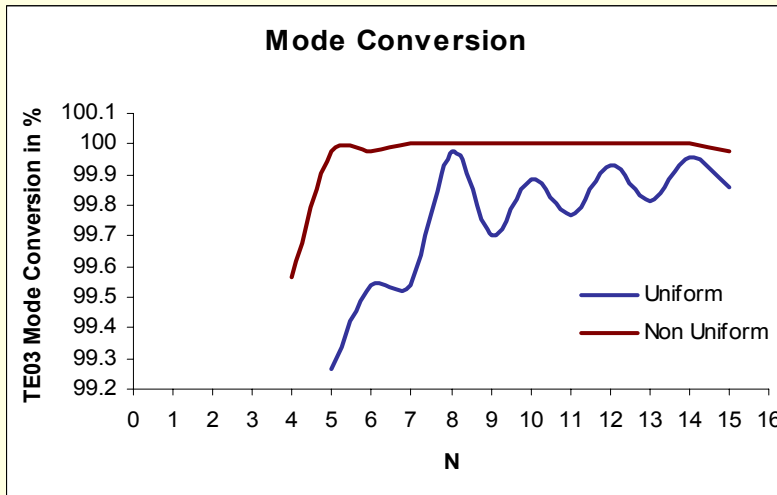
Converter Output

$TE_{01} \rightarrow TE_{02}$ Mode Conversion for $N = 6$ MB Converter

- Uniform:
 - 99.98% mode conversion
 - 392.4 MHz bandwidth
- Non-Uniform:
 - 99.93% mode conversion
 - 545.2 MHz bandwidth



$TE_{02} \rightarrow TE_{03}$ MB Mode Converters



- MB and MRIM are equivalent; the optimum radius is the maximum radius
- Results were similar to the $TE_{01} \rightarrow TE_{02}$ converter, except for the uniform mode conversion oscillation

Future Work

$TE_{o1} \rightarrow TE_{o2}$ MB

Converters To Be Tested

- Uniform: $N = 4$
- Non-Uniform: $N = 6$

$TE_{o2} \rightarrow TE_{o3}$ MB

Converters To Be Tested

- Uniform and
Non-Uniform: $N = 6$

Summary

- MB optimization is superior to MRIM design
- Mode Conversion: Uniform vs. Non-Uniform
 - $TE_{o1} \rightarrow TE_{o2}$: at approximately six ripples, mode conversion is comparable
 - $TE_{o2} \rightarrow TE_{o3}$: non-uniform design is more stable
- Bandwidth is always better for the non-uniform ripple design