

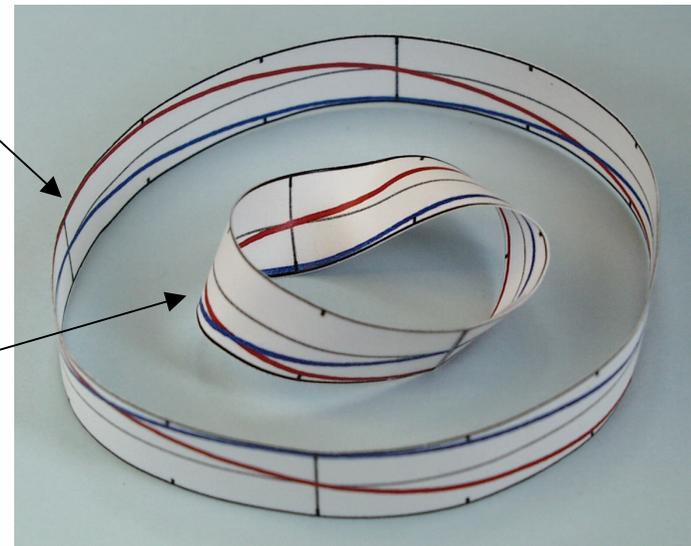
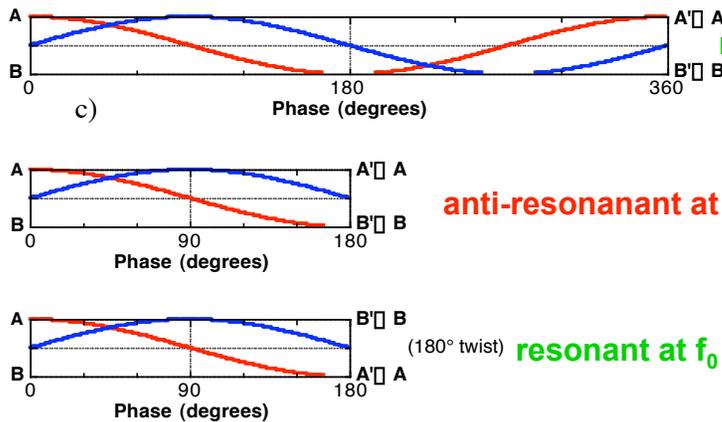
Möbius Resonators

IEEE Trans. Microwave Theory and Tech., vol. 48, no. 12, pp. 2465-2471, Dec. 2000.

- **Principles of non-orientable surfaces**
 - the concept of “left” and “right” is globally nonsensical
 - the Möbius strip is the prototypical non-orientable surface
 - common description of a Möbius strip is that it has one surface and one edge
- **Combines time-delay phase shift with geometric-deformation phase shift**
 - realize resonance at half the frequency of a “conventional” geometry
 - reduce the size, weight, and volume of a resonator
 - as implemented, a conductor defines the boundary circle and an electric field flux line can be considered to be the surface
- **The unique properties of non-orientable surfaces are compatible with the spatial oscillation of an electromagnetic wave**
 - resonates when the electromagnetic field is phased with the “flipping” between “left handedness” and “right handedness” of a non-orientable surface
 - Möbius resonators are dual-mode and possess intrinsic transmission zeros

Concept and dual-mode properties

- **Sinusoidal** and **cosinusoidal** patterns are plotted on “transmission lines”
- Resonance requires the fields and their derivatives match smoothly when $A' \rightarrow A$ and $B' \rightarrow B$
- When $A' \rightarrow A$ and $B' \rightarrow B$, the 360° - length line (top) and the 180° - length line with twist (bottom) both resonate at the same frequency



Möbius and conventional resonators

- Wire structures fabricated from 0.085-inch diameter coax from which the outer conductor has been removed
- Several Möbius wire geometries and conventional wire geometries were fabricated with the same mean diameter

← 1.90 cm →

Simple (4π)
Möbius resonator



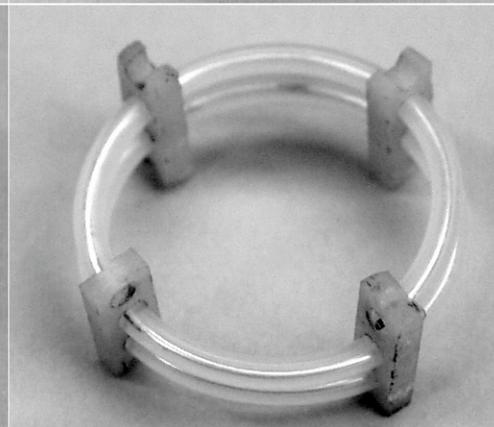
Twin (parallel)
loop resonator



Self-intersecting
(8π) Möbius resonator



Two-turn (4π)
helix resonator



Measured response of Möbius and conventional resonators

Simple (4π) Möbius resonator

Two-turn (4π) helix resonator

Self-intersecting (8π) Möbius resonator

Twin (parallel) loop resonator

