Dielectric Resonator-Based Left-Handed Metamaterials: Guided Wave
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Introduction

Left-Handed Metamaterials (LHMs)
• Properties
  - Negative permittivity and permeability (support backward wave: \( v_p = -v_g \))
  - Negative index of refraction
• Conventional Implementations
  - Split ring resonators (-\( \mu \)) with metal wires (-\( \sigma \))
  - Transmission line approach: series capacitance & shunt inductance
• Dielectric-Resonator (DR) LHM Implementation
  - Use TE01 mode of DR to provide -\( \mu \)
  - Place DR in cutoff background which provides -\( \sigma \)

Driven Model: Transmission Characteristics

Transmission Characteristics

Dispersion Diagram

Experimental Results

Backward wave

H-field (11 GHz)
E-field (11 GHz)

Rectangular waveguide

Parallel Plate

Transmission Characteristics

Dispersion Diagram

2-D RH-LH-RH structure

Triangular prism of LH region (Region 2)