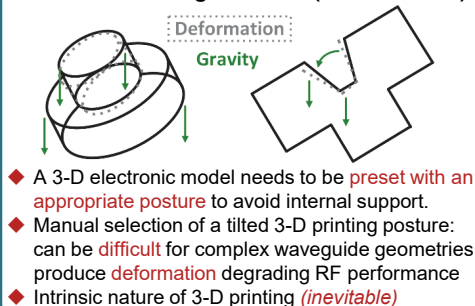


# A Fully 3-D-Printing-Compatible *E*-Plane Elliptical Waveguide Junction for Power Dividing/Combining Applications

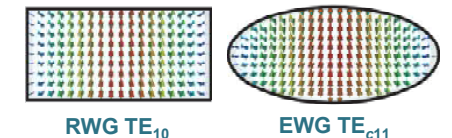
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STATUS QUO

## Tilted 3-D Printing Postures (Conventional)

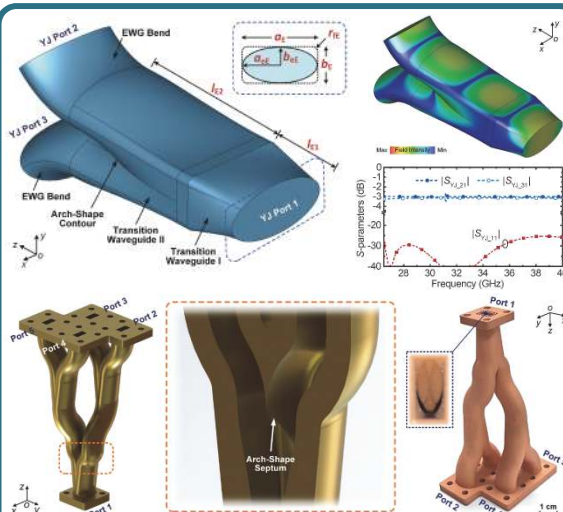
- 
- ◆ A 3-D electronic model needs to be **preset with an appropriate posture** to avoid internal support.
  - ◆ Manual selection of a tilted 3-D printing posture: can be **difficult** for complex waveguide geometries produce **deformation** degrading RF performance
  - ◆ Intrinsic nature of 3-D printing (*inevitable*)

NEW INSIGHTS



- **Orientation-designated geometrical shaping**
- **Utilized transmission line architecture: elliptical waveguide (EWG)**
  - ✓ Dominant mode:  $TE_{c11}$
  - ✓ EM field distribution similar to  $TE_{10}$  (rectangular waveguide)
  - ✓ Continuous and smooth surface profile (self-supportable & 3-D-printing-compatible)

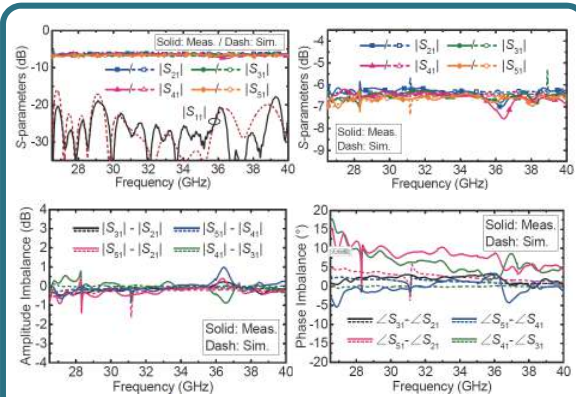
DESCRIPTION



- ***E*-Plane EWG Junction With Arch-Shape Septum**
  - ✓ Achieve wideband impedance matching
  - ✓ Enable "self-supportable" feature along the  $oz$  axis
- **Transition Waveguide I**
  - ✓ Built by lofting between an EWG and a filleted RWG
- **Transition Waveguide II**
  - ✓ Composed of two partially nested filleted RWG-to-EWG transitions (forming the arch-shape septum)
- **Four-Way Power Divider (EWG Junctions + Bends)**
  - ✓ Monolithic integration (Polyjet 3-D printing + Cu plating)



QUANTITATIVE IMPACT



PROPOSED CONCEPT GOALS

- **Compact size, good RF performance (26.5–40 GHz):**  
RBW: 40.6%, RL: >18 dB (mostly >20 dB)  
transmission coefficients:  $(-6.5 \pm 0.6)$  dB  
amplitude imbalance:  $\pm 1$  dB  
phase imbalance:  $(-5-17.7)^{\circ}$
- **Orientation-designated shaping along the  $oz$  axis**
- **Smooth and intrinsically self-supportable waveguide sidewalls (fully 3-D-printing-compatible)**
- **Internal support eliminated, deformation minimized**
- **Design principle applicable to *H*-plane EWG junctions**

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