Virtual Prototyping of a Microwave Fin Line Power Spatial Combiner Amplifier

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Introduction: This study describes the Virtual Prototyping of a novel X-Band Fin Taper (FT) Spatial Power Combiner (SPC) Amplifier based on rectangular waveguide (WG). Thermal expansion induced by the power dissipation of the active devices, is employed to compute Electric Fields and S-parameters in working conditions.

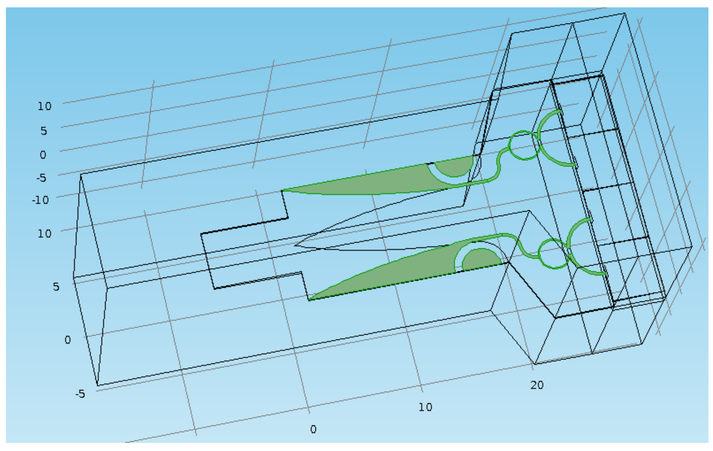

Figure 1. The proposed SPC.

Computational Methods: Thermal Stress (TS) and Electromagnetic (EM) analysis are coupled by Moving Mesh (MM) interface and by storing temperature information.

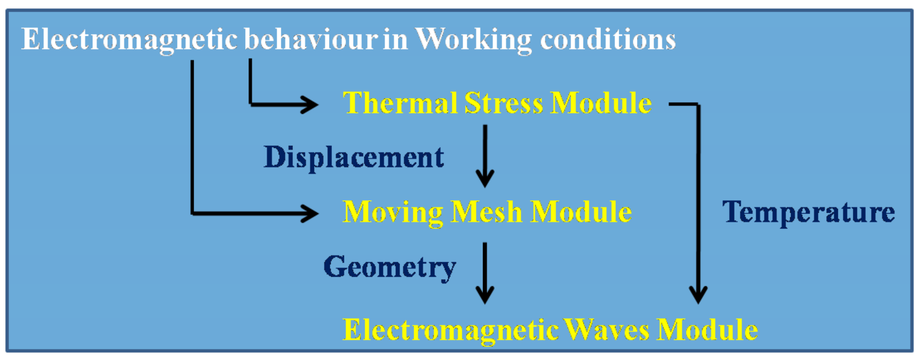

Figure 2. Computation Logical Diagram.

Fringe effects on the microstrip ports are considered by introducing a Perfect Magnetic Conductor (PMC) on a peripheral surface between the microstrip ports and the waveguide back open face, assigned to a Scattering Boundary Condition (SBC).

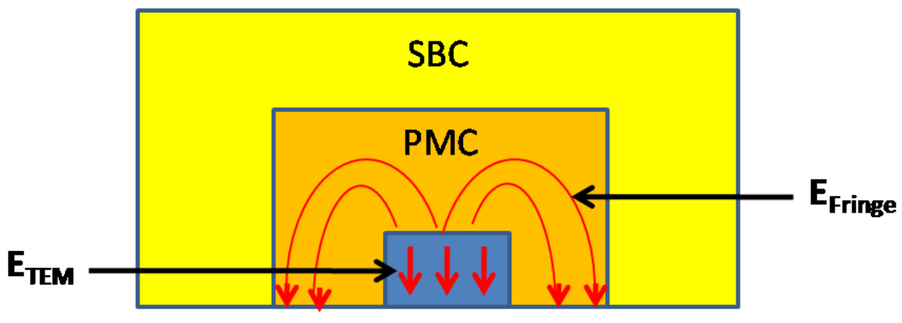

Figure 3. Fringe effects representation.

Results: By imposing a power dissipation of 20 W for each of the 4 GaAs active devices, (considering their conversion efficiency), the electromagnetic behavior is in-line with design requirements; but displacement value is incompatible with the GaAs survivability: for such reason, an interface layer is needed between the back of the GaAs active devices and the copper carrier: used materials are CuW or CuMo.

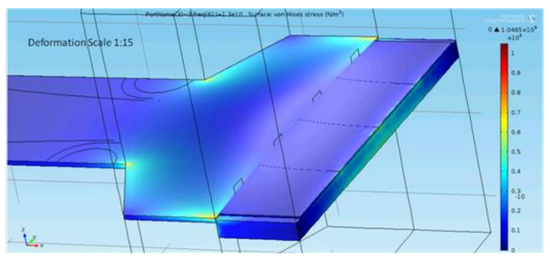

Figure 4. Stress.

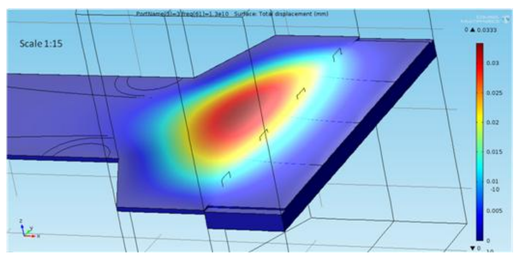

Figure 5. Displacement.

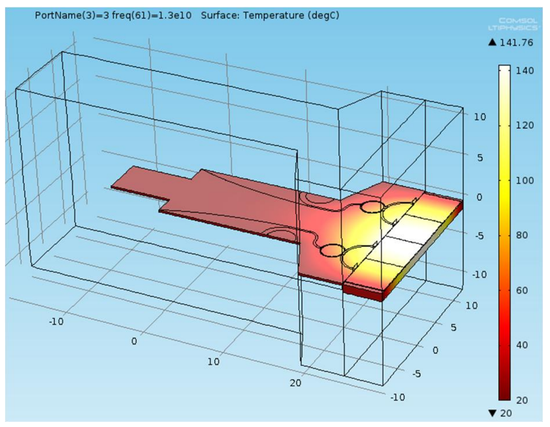

Figure 6. Temperature.

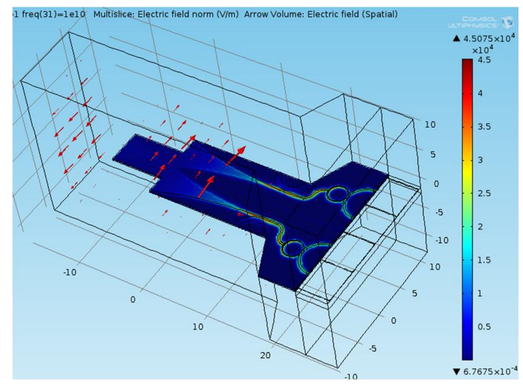

Figure 7. Electric Field.

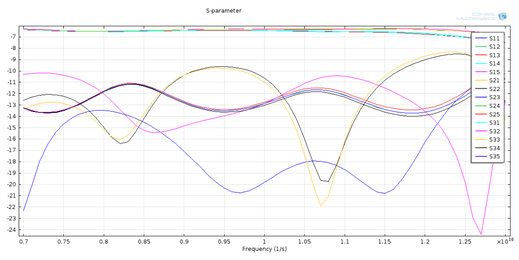

Figure 8. S-Parameter.

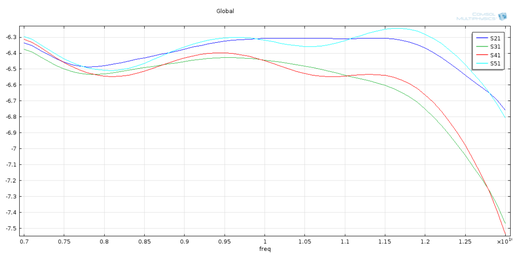

Figure 9. Transmission.

Conclusions: A complete Multiphysics model of the proposed SPC has been implemented and it has allowed to choose proper materials.

References:

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