# High Power Microwave Polarization Rotator

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In this paper, we introduce a new metamaterial-based polarization rotator, which is comprised only of metallic components and can be used in high power microwave (HPM) applications. In fact, the proposed HPM polarization rotator is a loaded waveguide which acts like a filter. The device is supposed to keep preferred polarization of an input signal and reflect the undesirable polarization.

The approach proposed in this paper for implementing polarization rotators is using chiral metamaterials (CMM). In such materials, the direction of polarization of linearly polarized light is rotated as the beam propagates through the material. More specifically, in our design first Group theory is used to design a Zia-based all metallic complementary metamaterial that shows chiral properties as wave passes parallel to its plane. The designed periodic metamaterials then are etched into two metallic plates. The plates are inserted into a S-Band waveguide, in parallel to waveguide walls. Since in the designed loaded waveguide left circular polarized light has a different transmission coefficient through the material than right circular polarized light, by transmission through the loaded waveguide, a linearly polarized wave is converted to its cross polarization with an efficiency of over 90%. The device has been designed to work effectively at 2.5 GHz. Simulation shows an averaged transmission loss of −0.5 dB and a reflection of −20 dB which makes the proposed device a promising candidate for HPM polarizer applications.

The proposed polarization rotator is all-metallic. The absence of dielectric materials makes the structure compatible with the various high power microwave environments, where dielectric breakdown is common and traditional, metamaterials could not be used in such applications.