Operation of the Ferrite Junction Circulator

The operation of symmetrical circulators is described in terms of the counter-rotating normal modes (fields varying as exp n phi) of the ferrite-loaded circuits. The rotating modes, which are split by the applied magnetic field, form a stationary pattern which can be rotated in space to isolate one of the ports of the circulator. A detailed field theory of the strip-line Y-junction circulator operating with n = 1 is presented. Experiments designed to confirm the validity of the rotating normal mode description of circulator action in the Y-junction circulator also are presented; these include measurements of mode frequencies and electric field patterns. The results of the field theory are used in a design procedure for quarter-wave coupled strip-line circulators. The results of the design procedure are shown to compare adequately with experimental circulators. Higher mode operation of strip-line circulators is described. The operation of waveguide cavity circulators is shown to depend on the rotating ferrite-loaded cavity modes.

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