Title:
Design and construction of slotted array antenna feed by wiggly ridge substrate integrated waveguide

Abstract:
A suitable procedure for design of linear arrays of centered longitudinal shunt slot is proposed, which allows it to largely suppress the second order beams. New slotted array antenna fed by wiggly ridge SIW is proposed. In suggestion antenna by varying the wiggle depth, the amount of power coupled to the slot can be adjusted but in longitudinal slotted antenna fed by rectangular waveguide the amount of power coupled to the slot be adjusted by varying slot offset of centerline, therefore slot offset is eliminated and slot place in waveguide centerline. In continuance, the design of a broadside resonant linear array antenna of longitudinal slots on substrate integrated waveguide (SIW) for uniform aperture distribution and for a symmetric tapered distribution is presented. The concept of SIW has been proposed and used in which an artificial waveguide is synthesized and constructed with linear arrays of metallized via-holes or posts embedded in the same substrate used for the planar circuit. The SIW has been suitably converted to an equivalent rectangular waveguide. Elliot’s design procedure has used regardless of the internal higher order mode coupling, for the usual range of thickness of the substrate, has been followed to obtain the optimum dimensions slots and amount depth wiggle ridge under each slot. Whereas different Between proposed design procedure and Elliott’s design procedure for design a Linear Array of Longitudinal Slots is, use wiggle shape for ridge placed under each slot instead of offset each slot of waveguide center line and this point is design innovation in thesis. The data for reflection coefficient parameter and self-admittance of an isolated proposed slot as a function of its length and amount each wiggle depth, a requisite in recent design procedure, has been generated by a commercially available full-wave finite element package Ansoft HFSS using an equivalent circuit for the slot with a subsequent extraction of Stegen-type curves. The required aperture distribution which is the slot voltage distribution for a slot array antenna is obtained by fitting the array factor to Chebyshev’s polynomial using Dolph-Chebyshev array synthesis procedure. The aperture distribution along with the polyfitted expressions of Stegen-type curves is then used in an iterative method to generate the design values of slots' lengths and wiggles depth. The structure with dimensions found from this design is simulated and tuned to generate the radiation patterns and S-parameters. The transverse electric field in slot aperture for slot lengths within 5% of resonance is also derived and demonstrated. The results show that the shunt equivalent admittance is a good approximation for longitudinal slot antenna fed by wiggly ridge SIW. The simulation results show the butterfly lobe suppression 14 dB for longitudinal slotted array with 5 slot, is designed.

Keywords:
Longitudinal shunt slot antenna, Butterfly lobes, Wiggly ridge waveguide, Wiggly ridge substrate integrated waveguide, Rectangular waveguide, Slot, Transverse electric field