2. Title: Dielectric rod based mechanical tuning technique for Substrate Integrated Waveguide (SIW) circuits

Inventor: Prof. Shiban K. Koul, Centre for Applied Research in Electronics

Key words: Waveguide circuits, Variable Phase shifters

Domain: Communication

Summary: The technique uses dielectric rods which are machined from very easily available substrates/ ceramic material in laboratory. These rods are embedded inside the planar SIW circuits like filters, antennas, and phase shifters. The demonstrated tuning technique involves mechanical replacement of all the dielectric rods (that are inserted into the air holes which are drilled through the substrate of the SIW circuits), with another set of dielectric rods, having different value of relative permittivity from that of the first set. As their relative permittivity changes, the circuit becomes reconfigurable, and its frequency response gets shifted to other frequency for the designed filter, antenna, and diplexer. And for the variable phase shifter, the relative phase shift changes with change in relative permittivity of dielectric rods.

» Tunability in center frequency of SIW filter achieved with variation in relative permittivity, and position of dielectric rods

» Tunability in resonant frequency of SIW antenna achieved with variation in relative permittivity of dielectric rods

» For variable phase shifter, relative phase shift changes with change in relative permittivity of dielectric rods and number of dielectric rod loading

Advantages:

» Simple, cost effective and easy to integrate

» Does not require external DC bias and hence there is no parasitic effect which makes it more reliable module

» Less power consumption due to elimination of external DC bias circuitry usage.

» No frequency limitation like varactor diode based tuning techniques.

» Low loss in comparison to metallic screw/post based other mechanical tuning techniques.

Applications:

» Multiband communication system, Multichannel front-end module

» Wideband tracking receiver

» Software defined radio

» Military and civilian radar

» Advanced Point to Multipoint Communication

Scale of Development: A functional prototype is fabricated and proof of concept is demonstrated in Laboratory environment.

Technology Readiness Level: 4

IP status: Indian Patent Applications 202011050070, 201911030536, and 202011019851