TE/TM Simulation of Interferometric Measurements

Bijan Houshmand
Jet Propulsion Laboratory
California Institute of technology
4800 Oak Grove Drive
Pasadena, CA 91109-8099
bh@athena.jpl.nasa.gov

Interferometric synthetic aperture radar (IFSAR) measurements at X-, C-, L-, and P-band are used to derive ground topography at meter level resolution. Interpretation of the derived topography requires attention due to the complex interaction of the radar signal with ground cover. The presence of penetrable surfaces such as vegetation, and tree canopies poses a challenge since the depth of penetration depends on a number of parameters such as the operating radar frequency, polarization, incident angle, as well as terrain structure. The dependence of the reconstructed topography on polarization may lead to the characterization of the ground cover. Simulation of interferometric measurements is useful for interpretation of the derived topography (B. Houshmand, Proceedings of URSI, 314, 1997). In this talk , time domain simulations for interferometric measurement for TE- and TM- polarization are presented. Time domain simulation includes the effects of the surface material property as well geometry comparable the radar signal wavelength (B. Houshmand, Proceedings of the URSI, 25, 1998). The IFSAR simulation is carried out in two steps. First, the forward scattering data is generated based on full wave analysis. Next, the electromagnetic information is inverted to generate surface topography. This inversion is based on the well known IFSAR processing technique which is composed of signal compression, and formation of an interferogram. The full wave forward scattering data is generated by the scattered-field formulation of the FDTD algorithm. The simulation is carried out by exciting the computational domain by a radar signal. The scattered field is then computed and translated to the receiving interferometric antennas using the time-domain Huygen's principle. The inversion process starts by compressing the time-domain data. The range compressed data from both receivers are then coregistered to form an interferogram. The resulting interferogram is then related to the ground topography using the radar imaging geometry. In this talk, the simulation results are compared with the C-band TM IFSAR derived topography, and the TE/TM SAR images at L-Band.