8.1 POLARIMETRIC VARIABLES ON THE PLANAR PHASED ARRAY RADAR: APPROXIMATE COMPUTATIONS

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Considered is the Polarimetric Planar Phased Array Radar (PPPAR) that has micro strip patch radiating elements. The elements have two ports. Port one excites intended horizontal polarization and port two excites intended vertical polarization. The intended polarizations coincide with the actual polarizations if the plane of the antenna is vertical and the pointing direction is broadside. The intended polarizations are orthogonal if the pointing direction is in the principal planes of the antenna. In the vertical principal plane the intended vertical polarization is not vertical with respect to earth but is accepted for computing the polarimetric variables as in the case of a parabolic dish antenna. Out of the principal planes the intended polarizations are not orthogonal and to compute the polarimetric variables the returns need to be adjusted. One method of exact computation requires solving a set of at least three coupled linear equations. Although simple in principle it requires precise knowledge of the coefficients of these equations. This is quite challenging because the absolute values in the analogue part of the radar system are hard to measure or estimate. An approximation for computing the polarimetric variables is suggested. It can be applied to the alternate mode of polarization change whereby the H and V polarizations are transmitted sequentially but both are received simultaneously. It can also be applied to the simultaneous mode of transmission and reception if the transmitted polarizations are phase coded from pulse to pulse. Adjustment suggested here computes the powers and correlations of the returned signals from ports 1 and 2 and combines these into a ratio to obtain the differential reflectivity. The one absolute value needed is the angle between the intended vertically polarized field and the actual field. The field of view (azimuth versus elevation) over which the approximation holds is plotted. In the region close to the principal planes the approximation may break down therefore it is suggested that computations valid for the principal planes be extrapolated to the nearby region.