Paper ID: 17884
oral

SPACE SYSTEMS SYMPOSIUM (D1)
Enabling Technologies for Space Systems (2)

Author: Dr. Bo Yang
Northwestern Polytechnical University, China

SELF-CALIBRATION OF SPACEBORNE MEMBRANE PHASED ARRAY

Abstract

Spaceborne membrane phased array antenna is manufactured on light membrane structures. Such technology enables larger antennas for space communication and earth observation. One of the problems of adopting such technology is as the result of lack of mechanical rigidity, membrane structure is prone to distortion. Distortion may be introduced during launch vibration, during folding and deploying process or caused by long term thermal effect. As the result of distortion, relative position of array radiation elements will move and generate relative phase errors which dramatically degrade antenna performance and imaging capability. Therefore, these phase errors need to be calibrated and compensated. Using reflective signal from illuminated patch can calibrate the antenna. This kind of technology is more convenient because no ground facility need to be established. The algorithm processes signal reflected from noncoherent ground scatterers and takes advantage of the statistical properties of the backscattered clutter signal to correct phase errors in the array. The key idea of this technique is that a homogeneous clutter scene will make the phase of the ensemble correlation between signals received by adjacent array elements equal to zero. Thus any variation of the correlation from this zero phase can be attributed to relative phase error between the two elements and therefore can be used to calibrate the array. Our algorithm is based on such noncoherent scatterer algorithms, the difference from former ones is that the independent well calibrated transmitting antenna has been removed to reduce support structure complexity. Although add some computation complexity, our method minimized the structure demand, reduced cost, and achieved real self-calibration by using uncalibrated antenna array to calibrate itself. Since transmitting antenna and receiving antenna are the same array. This algorithm can calibrate transmit channel and receive channel at the same time. Simulation demonstrates the principle of the algorithm and show promising results for further investigation.