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DYNAMIC COMPENSATION OF DETERIORATED ANTENNA PATTERN BY DEFORMATION OF LARGE DEPLOYABLE REFLECTOR OF MOBILE COMMUNICATION SATELLITE.

Abstract

Satellite for next generation mobile satellite communication service with small personal terminal requires onboard antenna with very large aperture reflector larger than twenty meters diameter because small personal terminal with lower power consumption in ground base requires the large onboard reflector with high antenna gain. But, large deployable antenna will deform in orbit because the antenna is not a solid dish but the flexible structure with fine cable and mesh supported by truss. In case of phased array antenna with digital beam former, beam performance and property can be modified with adjustment and optimization of excitation amplitude and excitation phase. Fundamental concept of our proposal is that beam pattern and antenna performance can be compensated with the updated excitation amplitude and excitation phase parameters optimized for the reflector shape measured with vision metrology in orbit every moment. In our previous study, feasibility of photogrammetric network for vision metrology for large reflector on board communication satellite has been confirmed. We are developing the beam compensation simulator. The purpose of the simulator is the testing and prototyping the derivation scheme of optimized excitation amplitude and phase parameter with measured reflector shape. In this study, reflector shape is assumed to be measured by vision metrology technique with several cameras onboard. In this report, feasibility to optimize excitation amplitude and phase parameter for deformed parabola reflector is discussed. The antenna pattern deterioration property is studied for various kinds of deformation of reflector expected from the thermal and structural consideration of deployable antenna. Reflector deformation with linear inclination provides the beam wandering and change of beam center position different from designed one, which is actually observed with the experiment with engineering testing satellite VIII (Kiku-8). We have confirm that the antenna pattern deteriorated due to reflector deformation can be compensated with optimized excitation parameter derived by maximum ratio combining method. These results shows that our proposed scheme is a feasible one.