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基于子阵列的低轨星载多波束相控阵天线的设计与实现

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The Design and Implementation of Sub-arrayed Phased Array Antenna for LEO Satellite

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摘 要 该文针对采用CDMA通信体制的低轨通信卫星，设计了具有“等通量”覆盖的平面阵列多波束天线，克服了卫星波束大角度扫描带来的“边缘问题”和“远近效应”。采用遗传算法对正六边形天线阵列进行综合，结合“子阵”分割理论，在波束空间和阵元空间进行子阵分割，简化了波束赋形的参量数目，同时还提出了一种波束成形网络复用结构，节省了2/3的资源。最后研制了16波束相控阵发射天线，其平面近场测试结果表明天线各指标都符合设计要求，有效验证了算法的正确性。

关键词： 相控阵天线 数字波束形成 遗传算法

Abstract： This paper presents a practical scheme of equal flux beams coverage and frequency multiplex according to CDMA standard utilized by LEO satellites, which can reduce the effect of “corner problem” and “near and far problem”. Genetic algorithm is adopted to realize the synthesis of hexagonal antenna, based on “sub-array” theory. The partition of sub-array in beam-space or element-space can reduce the number of beam-forming coefficients. A multiplex structure for beam-forming network is proposed, which can reduce the resource consumption by 67%. Ultimately a phased array antenna (TX) is designed. The experiment result demonstrates that all the parameters of phased array antenna are consistent with the target of design, which validates the rationality and feasibility of genetic algorithm.

Keywords： Phased array antenna Digital Beam Forming(DBF) Genetic algorithm

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