Cassegrain antenna : report

Entertainment

Introduction

The two-reflector system invented by Nicholas Cassegrain has been used extensively in optical telescopes, primarily to achieve a long effective focal length with a convenient physical configuration. During the late 1950s, widespread interest developed in the use of this type of system for microwave frequencies.

Axially symmetrical dual-reflector antennas (Cassegrain) classical or shaped) are of interest in radio astronomy and in Earth-station antennatechnology. The design of such systems is often restricted by some mechanical constraints, the type of feed horn used, and the budget of the project (closely related to the size of the reflectors). Taking into account all of the above, various sets of input parameters, representing various solutions, are considered. From these input parameters, the overall geometry of the antenna is derived in closed form. •What is a Cassegrain antenna?

In telecommunication and radar use, a Cassegrain antenna is an antenna in which the feed radiator is mounted at or near the surface of a concave main reflector and is aimed at a convex subreflector. Both reflectors have a common focal point. Energy from the feed unit (a feed horn mostly) illuminates the secondary reflector, which reflects it back to the main reflector, which then forms the desired forward beam. Cassegrain antenna is a double reflector system which has many interesting features such as high efficiency, low noise temperature performance, and easy accessibility to electronic equipment. 1Photo: Cassegrain antenna 02 Geometry: The classical Cassegrain geometry, shown in the below fig, employs a parabolic contour for the main dish and a hyperbolic contour for the sub dish. One of

the two foci of the hyperbola is the real focal point of the system, and is located at the center of the feed; the other is a virtual feed point which is the real focal point of the system, and is located at the center of the feed; the other is a virtual focal point which is located at the focus of the parabola.

As a result, all parts reflected from both surfaces, travel equal distances to a plane in front of the antenna. Fig: Geometry of Cassegrain Antenna Geometrical parameters for selected Cassegrain antenna Type Cassegrain Focal length fm= 1. 5meter Aperture size X Dx= 2meter Aperture size Y Dy= 2meter Magnification M= 5 Interfocal length fs= 1. m 03 Advantages: 1. Less prone to back scatter than simple parabolic antenna. 2. Much more compact for a given f/d ratio. 3. Reduction in spill over and minor lobe radiation. 4. Ability to place the field in a convenient position. 5. Capability of the scanning and broadening of the beam by moving one of the reflector surfaces. Drawback of Cassegrain antenna: Antenna, which whether transmits or receives correct signal or not is our main care and our direction, is an important part in anycommunicationsystems.

Because of the characteristics of laser different from radio, the antenna system of point-to-point laser communication system must be designed strictly. Newton system, Green system and Cassegrain system are accepted commonly in optical antenna systems as field lens which include refraction system, inflection system and refraction-and-inflection system. In this paper, Cassegrain antenna is discussed. However, the potential problem of sheltering ratio in Cassegrain system leads to a loss of effective power of the optical system so called vignette phenomena.

The other is related to optical aberration, because Cassegrain antenna sacrifices sight field for perfect image. 04 Applications: 1)ASTRO-G/VSOP-2 off-set Cassegrain telescope The VSOP-2 satellite has an offset Cassegrain antenna. The antenna consists of a 9-m mesh-surface paraboloid main reflector, a solid hyperboloid sub-reflector, and three feed horns. The satellite has 8. 0, 22, 43 GHz band receivers. The main reflector is consisting Of 7 hexagonal modules. The radial rib structure is newly adopted for the modules to shape a surface with accuracy of 0. mm-rms. And three band feed horns are juxtaposed at the Cassegrain focus. 05 2)Cassegrain Antenna With Hybrid Beam Steering Scheme for Mobile Satellite Communications. A hybrid antenna (HA) with a modified beam steering method is proposed. This antenna has a Cassegrain structure composed of two reflectors and a feeder. The parabolic-shaped main reflector is designed for high gain, while the subreflector is rotational and flat. The feeder is a phased array with arbitrary shaped aperture and 20 element antennas.

The HA is capable of two-dimensional beam steering by means of two operations: rotation of the subreflector and phase control of the feed array. The subreflector is small in size and weight, so it can provide rapid beam scanning. Designed to be loaded in vehicles, the HA and can communicate with satellites on the move by tracking the beam control of the feed array. A prototype of the HA is fabricated with aluminum using a machining center operated by computerized numerical control. The prototype is operated at Ka-band for TX and K-band for RX with gains of 47 dBi and 44. dBi, respectively, at a steering angle of 0 . The two-dimensional beam steering within +/- 2 degrees withrespectto 45 elevation is realized by the

subreflector and feed array. All radiation patterns in the beam steering zone meet ITU-R s. 465-5 regulations. 06 Conclusion: This report contains the information of what is a Cassegrain Antenna and its design parameters. We learnt of how the parabolic reflector and hyperbolic subreflectors are designed based on the geometry of the Cassegrain Antennas. We have shown some of the advantages of this antenna over other antennas and the principle drawback of this antenna.

We have shown two major applications of this Antenna which deals with the design of Cassegrain telescope and a beam steering scheme for mobile satellite telecommunications. 07

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