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Design of structures required for Replacement of Quadripod structure at GMRT antenna

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Abstract

The longevity and precision of astronomical observations hinge on the optimal performance of antenna structures, yet the open atmosphere poses a persistent threat of corrosion to vital components. The Quadripod (QPD) structure of the C03 antenna at the Giant Meter wave Radio Telescope (GMRT) has succumbed to significant corrosion in 20 years, compelling an urgent need for replacement. This paper introduces an innovative approach to combat corrosion through the design of required structures, specifically focusing on Columns. Additionally, the paper details the meticulous design of essential components, including lifting and resting mechanisms, to facilitate the seamless replacement of the antenna. The proposed design addresses safe lowering and lifting of the antenna. This paper contributes a comprehensive solution to safeguard against corrosion-induced degradation and lays the foundation for sustained excellence in radio telescope operations. The column design is strategically engineered to allocate the load-bearing responsibility among three out of four columns, ensuring the safe lowering of the antenna structure. This paper delves into the preliminary considerations for maintaining damaged pipes at the Quadripod (QPD) of the antenna. Our investigation involves the development and analysis of three distinct configurations aimed at addressing corrosion issues within the QPD structure. Out of these configurations, one has been adopted for the replacement of the QPD structure. In conclusion, the innovative approach presented in this paper not only addresses the urgent need for replacement of the corroded Quadripod structure at the Giant Metre wave Radio Telescope (GMRT), but also showcases our in-house technical expertise in combating corrosion-induced degradation. By meticulously designing essential components and implementing strategic engineering solutions, we have laid the foundation for sustained excellence in radio telescope operations. Our commitment to pushing the boundaries of innovation and ensuring optimal performance underscores our dedication to advancing astronomical observation capabilities.

Keywords: Corrosion, Pulley design, Radio telescope, Structural design, Wire rope design