



GMRT Servo System: Motivations and challenges for the upgrades

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The servo system for GMRT antenna was designed in the 1990s jointly with BARC using permanent magnet DC (PMDC) servomotors and 8086 microprocessor based position control system. PMDC motors in the 30 antennas, which are spread across 25-km area, required very high maintenance efforts due to wear of carbon brushes. This led to loss of valuable astronomical observation time; besides having manpower and financial implications. Both these motors as well as 8086-based components are obsolete and present severe limitations in implementing state-of-art control algorithms. Servo group of GMRT has taken major steps in last 5 years to upgrade the servo system of the antenna by commissioning brushless DC (BLDC) servomotors in place of PMDC motors and by replacing 8086-based system by an industry standard, upgradeable and scalable PC104 based architecture to increase reliability, to reduce antenna downtime and maintenance and to overcome obsolescence of components.

The new challenges for these upgrades were reducing the RFI footprint of BLDC drives, implementing and validating the PC104 based position control system on the open-source real time Linux platform and improvement of antenna pointing accuracy by implementation of state-of-art control algorithms in antenna and feed position control system, with the upgrade taking place simultaneously with astronomical observations. The components of these upgrades and their current status are described here along with the possible future improvements.

Further, a smaller subsystem known as Feed Positioning system (FPS), has also been recently redesigned and prototypes have been deployed in few antennas. FPS precisely positions or focuses the feeds that are located on the four faces of the rotating turret. The telescope is to be operated at 610, 150, 1420 and 325 MHz. The feed can be positioned for desired frequency by rotating the turret. This positioning of various feeds itself was unreliable due to use of intermediate feedback which caused positioning errors while focusing feeds and hence introduced significant loss of observation time due to post-focusing calibration known as pointing of telescopes. This system's prototype have been deployed in antenna with load-side feedback, an absolute feedback and linear drive. This system is also based on PC104; which will eventually be migrated into third axis of main servo system.

1. G. Swarup, S. Ananthkrishnan, V.K. Kapahi, A.P. Rao, C.R. Subrahmanya, V.K. Kulkarni, "The Giant Metrewave Radio Telescope." *Current Science*, 60, 25, January 1991, pp. 95-105,