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Parallel Multi-Wavelength Calibration Algorithm for Radio Astronomical Arrays[☆]

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Abstract

In order to meet the theoretically achievable imaging performance, calibration of modern radio interferometers is a mandatory challenge, especially at low frequencies. In this perspective, we propose a novel parallel iterative multi-wavelength calibration algorithm. The proposed algorithm estimates the apparent directions of the calibration sources, the direction dependent and direction independent complex gains of the array elements and their noise powers. Furthermore, the algorithm takes into account the specific variation of the aforementioned parameter values across wavelength. Numerical simulations reveal that the proposed scheme outperforms the mono-wavelength calibration scheme and approaches the derived constrained Cramér-Rao bound even with the presence of non-calibration sources at unknown directions. Finally, simulation results on LOFAR real data assess the usefulness of the proposed scheme.

Keywords: Calibration, radio astronomy, radio interferometer, sensor array, direction-of-arrival estimation, consensus optimization

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