Error Analysis of Velocity Estimation via Bistatic Along Track InSAR

Wenqin Wang(1)

(1) Institute of Electronics, Chinese Academy of Scien, Room 309, Lab.8,Inst. of Elec. Chin. Acad. of Sci , 100080, China

Abstract

Bistatic SAR uses separated transmitted and receiver flying on different platforms. Such a spatial separation has several operational advantages in military applications the vulnerability of the system is reduced, because the transmitter can be positioned far away, while the passive receiver is difficult to locate. The bistatic along track interferometric SAR (AT−InSAR) model is one kind of bistatic SAR system, which makes transmitter and receiver platforms flying in the same flight direction. The combine of the bistatic SAR can obtain the phase of the AT−InSAR to measure the slow moving targets. In this paper, the influence of the main parameters measure error to the AT−InSAR speed measurement accuracy were investigated, such as the moving error of bistatic SAR, the interferometric phase error and the incidence angle error caused by thermal noise. Some correcting mathematical formula and relative curvature were also obtained. Theoretic analysis and numerical simulation results show that the desired results can be obtained under certain conditions. Finally, some recommendations for future work are presented. The organization of this paper is as follows: In section 1, the geometry model and basic principle for AT−InSAR were discussed. In section 2, the influence of the moving error of bistatic platforms to the AT−InSAR speed measurement accuracy was analyzed in detail, and one correcting mathematical formula to compensate this error was derived. In section 3, the interferometric phase error and the incidence angle error caused by thermal noise to the AT−InSAR speed measurement accuracy was analyzed, and some method to compensate this error was obtained. In section 4, the baseline measure error to the AT−InSAR speed measurement accuracy was analyzed in detail, it is pointed that the equivalent baseline between the two antennas must be modified to improve the accuracy of velocity measurement for slow moving targets. Finally, in section 5 various examples were presented and some difficulties and future works in improving the accuracy of velocity measurement with AT−InSAR were discussed. On the whole, this paper has discussed the influence of the moving error of bistatic platforms, the interferometric phase, the incidence angle and the baseline to the speed measurement accuracy in details, and got some useful results. It is believed that the results of this paper could provide theory and design for AT−InSAR system.

Appendix

Wenqin Wang was born in Sichuan province, P. R. China, in 1979. He received the B.S. degree from the University of Shandong in 2002 in electrical engineering and the M.S. degree from the University of Electronic Science &Technology of China (UESTC) in Mar. 2005, majoring in signal and information processing. Presently, he is pursuing his Ph.D. degree in the Institute of Electronics, Chinese Academy of Sciences. His main interests are associated with SAR system and signal processing, microwave imaging technology and modern signal processing. He has yet published over 30 papers in some technical journals and some conferences as the first author.

Communication Address:

Wenqin Wang Room 309, the 8th Laboratory, Institute of Electronics, Chinese Academy of Sciences, No. 19, Beisihuanxi Road, Beijing, P. R. China. Postcode: 100080