Space-borne SAR Received Data Simulation Based on Actual Scene Data

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Space-borne SAR is an important means to get ground information as technique of remote sense and microwave imaging, and acts a significant part in disaster surveillance, environment monitor and resource exploration, especially in the field of military. It can get two-dimensional high resolution image in range and azimuth direction through technique of pulse compression and synthetic aperture respectively. Furthermore, it has capacity of all-weather's work and penetrating through some covers, which are always out of reach of the optical sensor. Therefore, developing real space-borne SAR system becomes a domestic problem in dire to resolve at present. In order to ensure the designed space-borne SAR system to meet real need, it is necessary to perform space-borne SAR raw data simulation of actual scene in the situation of scheme design of space-borne SAR system and research of imaging processing algorithm. The experts of home and aboard have developed some research about simulation of SAR raw data. G. Franceschetti of Italy studied a method of raw data simulation based on scattering characteristic of actual ground target. Its principal is to introduce the model of facet and ground evaluation to calculate target's back-scattering coefficient, utilizing the model of received signal to generate SAR data by two-dimensional fast Fourier transform. An approach of area target's and distributed target's raw data simulation of space-borne SAR is given by some research people in domestic electronic lab. In general these methods simulate received data of targets with simple geometrical shape, but would fail to simulate data of actual ground scene (such as mountain forest, airport etc). In this paper, a simple method of simulating space-borne SAR raw received data based on airborne SAR real data is presented. Firstly, radiometric calibration is performed about gray data of airborne SAR image, and back-scattering coefficient of different targets is obtained. Then, raw data is generated using mathematical model of point target's received signal of space-borne SAR, and statistical characteristic of simulating data's amplitude is analyzed. Finally, imaging processing is fulfilled utilizing CS algorithm to received data of space-borne SAR. Statistic analysis and imaging result also indicate that the simulation method is correct and feasible. Raw data's simulation of space-borne SAR can help us perform optimum design of space-borne SAR system scheme, test and evaluate the performance of every imaging algorithm, and research motion error from satellite platform having influence on received data and image quality.