Implementation and validation of a new SAR data imaging processor based on efficient time-domain focusing core

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Abstract

In the very near future there will be a substantial increase in missions in the earth observation field that will exploit SAR sensors. Space agencies are deploying new missions with radar equipment able to provide images with ultra-high resolution and wider coverages and with the possibility to make innovative acquisitions able to exploit the squint in order to satisfy more user requests in a shorter time. Furthermore, there will be numerous SAR missions in which the sensors will be installed on small satellites with reduced capabilities compared to larger satellites but that will draw advantage from the enormous cost reduction and the consequent possibility to have constellations composed from numerous satellites concurrently in flight. Moreover, the presence of vehicles other than satellites such as sub-orbital platforms and UAV on which SAR sensors will be installed should be also considered.

New challenging scenario will lead to the presence of ultra-high resolution acquisitions on terrains with strong topography variation, high squinted acquisition, reduced attitude and orbit stability. The presence of these characteristics could result in a significant degradation for the imaging algorithms especially for those working in the Fourier-domain. The presentation concerns a new accurate and efficient image formation algorithm that uses a focusing core implemented in the time-domain, where the precise accommodation of high topography variations and the impact of the reduced platform stability during acquisition can be easily handled working on pixel basis. As is well known, however, the excellent performance that can be achieved with a processor in the time-domain is paid for with a significant worsening of the temporal performance. For this reason it is necessary to introduce algorithm optimizations to reduce the overall computational cost and make it compatible with near real time execution without introducing significant degradation in the focusing performance.

Keywords - Processing algorithms