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**K.N. Toosi University of Technology**

**Faculty of Geodesy and Geomatics**

**M.Sc. Thesis in Civil-Surveying Engineering**

**In Remote sensing**

**Evaluation of speckle reduction in unsupervised classification of polarimetric SAR imagery**

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**Abstract**

Speckle in Synthetic aperture radar images makes grainy effects, because of the coherent imaging system which cause some difficulties in object-oriented processes, like segmentation or classification. Therefore, a lot of methods have been developed for speckle reduction purpose. These methods can be classified but not limited in some approaches, like spatial based, transform based and optimization, which mostly suffer from limitations like edge and texture destruction and also regulating parameter dependence. In this research, at forst a new structure has been presented based on adaptive filtering of the amplitude response of the discrete Fourier transform of the image in the frequency space, which not only reduces the speckle but also preserves edges and delicate textures. In addition, it has low level of computation and complexity compared to the kernel dependent spatial approaches. At the second step, a novel hybrid metaheuristic algorithm is presented based on the total variation cost function, which provides high flexibility in speckle reduction and structure preservation, along with the automatic extraction of thresholds. The proposed algorithm improved the ENL and EPI indexes on multi-looked images by 10 and 2.5 times than the adaptive spatial filters, as well as on single-look images by 10 and 5 percent more, respectively. Finally an evaluation approach based on statistical hypothesis presented as a tool for further analysis of the proposed algorithms.

**Key words**: Polarimetric SAR imagery, Speckle reduction, Wavelet decomposition, Fourier transform, Denoising.