**Development of a New Algorithm for Temporal Decorrelation Adjustment in Forest Height Estimation Using RVoG Model**

###### **Abstract:**

In this research, we propose a novel algorithm for forest height estimation using polarimetric interferometry SAR data. The proposed method, entitled four-stage algorithm, can estimate the forest height using single baseline single frequency repeat pass PolInSAR data without the need for an auxiliary data or initial values of unknown parameters. Because of the temporal decorrelation effect on the repeat pass data, the new method proposes a geometrical solution to solve the random volume over ground with volume temporal decorrelation model. The four-stage algorithm estimates the mean extinction coefficient using a geometrical index to reduce the number of the unknown parameters. The new index is defined as a linear function of the position of the volume coherence on the coherence line based on the signal penetration in the vegetation layer. A real PolInSAR data is utilized to evaluate the suggested method in the RVoG+VTD model parameters estimation. The real data is acquired in the Remningstorp test site in the southern Sweden, BioSAR 2007 campaign, by ESAR airborn sensor which has 8 meters spatial baseline and 33 days temporal baseline. The experimental results in the RVoG+VTD model retrieval using the four-stage algorithm show the 5.4 meters improvement in compared to the RVoG model inversion using the three-stage method. Additionally, two different method, are proposed in this research to improve the conventional three-stage algorithm results in the forest height estimation. The first improved method selects the mean extinction coefficient range based on a geometrical index which is affected by the signal penetration. The second improvement method employs an exhaustive searching polarization optimization method to find the optimum volume only coherence. In what follows, the real PolInSAR data with small temporal baseline was used to evaluate the last two methods. The real data experimental results show that, the proposed methods improve the conventional three-stage result by 2.5 and 2.9 meters, respectively.

Key words: Forest height, volume coherence optimization, PolInSAR technique, Four-stage algorithm, Three-stage algorithm, Temporal decorrelation.