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ANALYSIS AND APPLICATION OF LIDAR WAVEFORM DATA USING A PROGRESSIVE WAVEFORM DECOMPOSITION METHOD

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Abstract. Due to rich information of a full waveform of airborne LiDAR (light detection and ranging) data, the analysis of full waveform has been an active area in LiDAR application. It is possible to digitally sample and store the entire reflected waveform of small-footprint instead of only discrete point clouds. Decomposition of waveform data, a key step in waveform data analysis, can be categorized to two typical methods: 1) the Gaussian modelling method such as the Non-linear least-squares (NLS) algorithm and the maximum likelihood estimation using the Exception Maximization (EM) algorithm. 2) pulse detection method—Average Square Difference Function (ASDF). However, the Gaussian modelling methods strongly rely on initial parameters, whereas the ASDF omits the importance of parameter information of the waveform. In this paper, we proposed a fast algorithm—Progressive Waveform Decomposition (PWD) method to extract local maxims and fit the echo with Gaussian function, and calculate other parameters from the raw waveform data. On the one hand, experiments are implemented to evaluate the PWD method and the results demonstrate its robustness and efficiency. On the other hand, with the PWD parametric analysis of the full-waveform instead of a 3D point cloud, some special applications are investigated afterward.

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