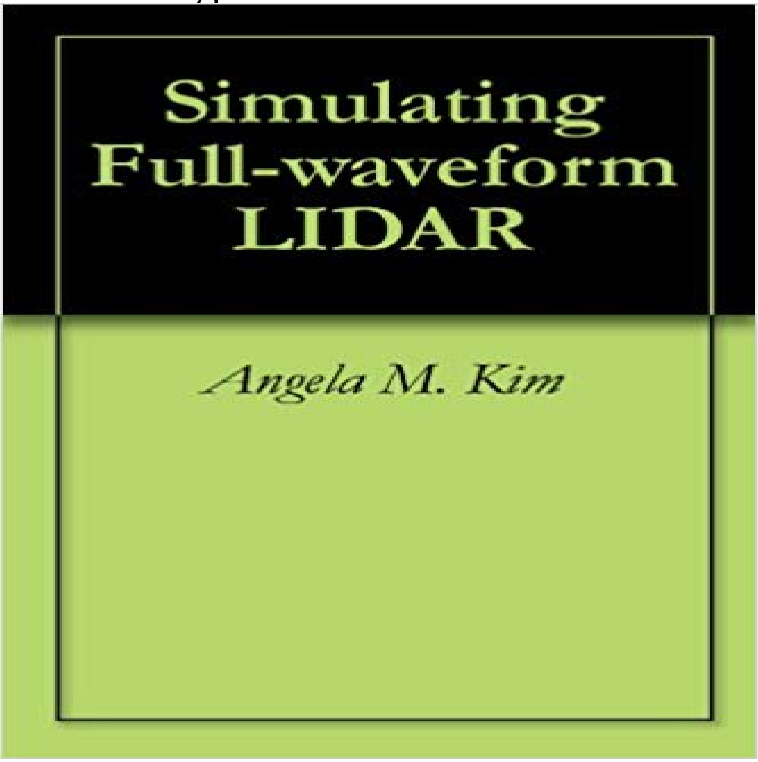
Simulating Full-waveform LIDAR



LIDAR (LIght Detection And Ranging) is used to remotely measure the three-dimensional shapes and arrangements of objects with high efficiency and accuracy by making precise measurements of time-of-flight of pulses of light. Discrete return LIDAR systems provide a discrete series of elevation points corresponding to reflections from objects in the scene. Full-waveform LIDAR systems measure the intensity of light returned to the sensor continuously over a period of time. Relatively little research has been done on full-waveform LIDAR signals. This thesis presents a Monte Carlo model of laser propagation through a tree which allows simulation of full-waveform LIDAR signatures. The model incorporates a LIDAR system and a natural scene, including an atmosphere, tree and ground surface. Test cases are presented which enlighten various aspects of the model, and give insight into full-waveform LIDAR data collection and analysis. Changes in the scene such as varying ground reflectance, sloped versus flat ground, and comparisons of leaf-on and leaf-off conditions are analyzed. Changes in the LIDAR system are also studied, such as changing laser wavelength, shape and length of transmitted pulses, sensing geometry, etc. Results of the simulations and analysis of the effects of physical changes in the scene and sensor are presented.

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A simple Monte Carlo model of laser propagation through a tree is presented which allows the simulation of full- waveform LIDAR signatures. **End-to-End Simulation for a Forest-Dedicated Full-Waveform Lidar** Simulation of small footprint full waveform LIDAR propagation through a tree canopy in 3D on ResearchGate, the professional network for scientists.