**SUMMARY**

**ON CONTRIBUTIONS OF DOCTORATE DISSERTATION**

Thesis’s title: ***“Ultra-wide Band Signal Processing Methods for Positioning Buried Objects.”***

Specialization: Electronics Engineering

Specialization code: 9 52 02 03

Ph.D. candidate’s name: Nguyen Thi Huyen

Research advisors: Assoc. Prof. Pham Thanh Hiep and Assoc. Prof. Vu Van Son.

#### Research location: Le Quy Don Technical University.

MAIN RESULTS OF THE DISSERTATION

1. A method of locating a single buried object in a homogeneous environment using a radio communication system with ultra-wideband (UWB) signals is proposed. The proposed method is based on the analysis of the received signal strength indicator (RSSI), time on arrival (TOA) of the reflected UWB signal from the buried object combine with the Gauss-Newton nonlinear estimation algorithm. Theoretical analysis and simulation results demonstrate that the proposed method can be used to determine the location and the shape of the buried object with the high accuracy.
2. The correlation function separation technique (CFST) for IR-UWB signal combine with Levenberg-Marquardt algorithm is proposed to locate the adjacent buried objects in a homogeneous environment. In the case of adjacent buried objects, the reflected signals will be partially overlapped depending on the distance between these objects. The CFST is used to separate the correlation values ​​from the overlapping signals and determine the time on arrival (TOA) of signal reflected from each individual objects. The CFST is evaluated based on the Cramer-Rao lower bound of the TOA and compared with previously published techniques. The calculation and simulation results indicate that CFST can be applied to locate the adjacent buried objects with significantly improved positioning error.
3. Proposal of the pulse position modulation with additional time shift for UWB signal (ATS-PPM-UWB) and shifting pulse technique (SPT-UWB) to locate the multiple buried objects in heterogeneous environment. In the ATS-PPM-UWB technique, the parameter of the PPM-UWB signal is optimally selected according to the UWB pulse shape. In the SPT-UWB technique, the time of transmitted pulse is adjusted in each pulse sequence. Both techniques are used to reduce the positioning errors in locating multiple buried objects in the heterogeneous environment. The calculation and simulation results show that the proposed techniques have significantly improved the performance of the UWB penetrating system.

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|  | Hanoi, September 18th, 2021 |
| **RESEARCH ADVISOR** Assoc. Prof Pham Thanh Hiep | **Ph.D. CANDIDATE** MS. Nguyen Thi Huyen |