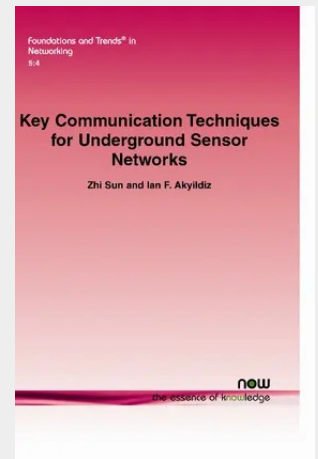


Key Communication Techniques for Underground Sensor Networks

Wireless Underground Sensor Networks (WUSNs) are the networks of wireless sensors that operate below the surface of the ground. The networks of wireless nodes are buried underground and communicate through soil. WUSNs can enable many novel and important applications, such as in-situ oil reservoir monitoring, concealed border patrol, underground power grid and pipelines maintenance, intelligent irrigation, earthquake and landslide forecast, mine disaster prevention and rescue, among others. Despite the potential advantages, the underground soil medium brings distinctive and significant challenges, which prevent the direct usage of most, if not all, existing communication and networking techniques. In Key Communication Techniques for Underground Sensor Networks, two enabling techniques are developed to realize reliable and efficient WUSNs, namely the EM wave-based WUSNs and the MI-based WUSNs. The book provides principles and guidelines for readers who are interested in WUSN designs. Specifically, for EM wave-based WUSNs, the dynamic network connectivity is first investigated based on a comprehensive channel model in the soil medium. Then, a spatio-temporal correlation-based data collection scheme is developed to reduce the sensor density while keeping high monitoring accuracy. For MI-based WUSNs, the MI waveguide technique is first developed to significantly enlarge the underground transmission range. Then, the optimal deployment algorithms are analyzed to construct the WUSNs with high reliability and low costs. Finally, the mathematical models are developed to evaluate the channel and network capacities of MI-based WUSNs. Key Communication Techniques for Underground Sensor Networks is the perfect reference for anyone interested in the research contributions, design challenges and considerable potential of WUSNs.



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