

# Preface

Wireless Sensor Networks (WSN) have found many applications in many domains. However, due to the deployment of WSNs in harsh environments, and also due to the battery powered nature of sensors, sensors may fail or cease to function properly. This Brief considers the resilient operation of WSNs in which data delivery from sensor nodes to the sink is guaranteed, even when some sensors fail, or when communication is impaired. Traditional protection schemes are either slow in reacting and recovering from failures or expensive in terms of backup resources, which are reserved to recover from failures. Therefore, this Brief covers protection strategies that use the technique of network coding, which have the advantages of overcoming the deficiencies of the traditional schemes.

Since network coding-based protection can be implemented in several ways, this Brief is divided into a number of chapters addressing theoretical bases and practical implementations. After a brief introduction to WSNs and the resilience problem in WSNs, this Brief introduces a basic centralized scheme, which applies to a restricted network topology, and will be introduced as an optimal solution. Then, the topology is relaxed to include practical wireless network topologies, and the scheme is generalized to apply to such topologies. Coding algorithms will be covered, which are based on using coding coefficients from the binary field. These include algorithms for performing deterministic coding with  $\{0,1\}$  coefficients at intermediate sensor nodes and for decoding at the sink to recover data. For large-scale WSNs, this Brief covers distributed network coding approaches, which can be used to recover from failures and from packet losses in WSNs. The transmission scheduling problem is important in order to achieve efficient usage of the wireless spectrum and avoid transmission collisions. Therefore, this Brief covers scheduling algorithms when digital network coding and analog network coding are employed. Practical considerations for the implementation of those algorithms will be covered.

This concise but in-depth coverage of network coding-based protection of WSNs should be of interest to researchers and graduate students in Electrical and Computer Engineering, as well as in Computer Science, who are interested in the topic of resilient WSNs. It should be also of interest to professionals working in the deployment of resilient WSNs.

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