

# ADAPTIVE CLUSTERING AND TRANSMISSION RANGE ADJUSTMENT FOR TOPOLOGY CONTROL IN WIRELESS SENSOR NETWORKS

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## ABSTRACT

A wireless sensor network (WSN) is characterized by a limited energy supply and a large number of nodes. Topology control (TC) as one of the main ways to control energy consumption in WSNs has been the focus of a considerable body of research.

Topology control algorithms can be divided into *duty-cycle-based* algorithms and *transmission-power-based* algorithms according to their energy saving approaches. By dynamically integrating the two approaches, I have developed a two-level topology control strategy to achieve further energy saving. Connected dominating set (CDS) as a very promising energy saving technique can be used with either a *transmission-power-based* algorithm or a *duty-cycle-based* algorithm. I have designed a distributed algorithm, DSP-CDS, for constructing CDS quickly in a single phase. I have developed an energy consumption model for clustered WSNs and use it to solve the optimal transmission range problem. This model provides us an insight into the energy consumption behavior in clustered wireless sensor networks and the relationship among major factors. Observing that traffic load often has unpredictable changes after deployment and has great impact on the optimal transmission range, I have designed a traffic-adaptive clustering algorithm, RDSP-CDS. RDSP-CDS is suitable for dynamic network topologies due to transmission range changes, node mobility, and/or node failure.

As a summary, the contributions of the dissertation include a two-level topology control strategy, a distributed connected dominating set construction algorithm (DSP-CDS), an energy consumption analysis model to solve the optimal transmission range problem in clustered WSNs, and a distributed traffic-adaptive clustering algorithm (RDSP-CDS) for non-uniform traffic networks.