



## Mathematical aspects in combining network coding with topology control

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### Abstract:

Combining topology control with network coding has been recently noticed which provides essential advantages such as lower energy consumption and higher lifetime. In this paper, we utilize optimization and graph theory to propose a mathematical perspective for combining network coding with transmission range adjustment in Wireless Sensor Network (WSN). For this aim, we define an extended optimization problem based on two vectors of variables including transmission range and network flow. In particular, it is proved that there is a coding solution if and only if the extended optimization problem has at least an optimal solution. Due to this theorem, a new objective function is provided which is more practical to prolong the lifetime of WSNs. The simulation results demonstrate that the proposed model could adjust transmission range efficiently to obtain the optimal lifetime for network-coding-based WSNs.

### Biography:

M. J. Nadjafi-Arani was born in Kashan, Iran, in 1984. He received the B.Sc. and Ph.D. degrees from University of Kashan, Iran, in 2006 and 2012, respectively, and M.Sc from Sharif University of Technology, Iran, in 2008, all degrees are in mathematics. In 2012, he joined the Golpayegan Branch, Sharif University and Technology, as a Lecturer, and in 2013 he holds in a Postdoc position in Sungkyunkwan University, Republic of Korea. Since August 2016, he has been with Mahallat Institute of Higher Education, Iran, as an Assistant Professor. His current research interests include metric graph theory and applications of graph modeling and probability in computer



science, chemistry, biological systems, and economy. Dr. Nadjafi-Arani is a life member of the American Mathematical Society and European Society of Mathematical Chemistry.

### Publication of speakers:

1. Khalily-Dermany, Mohammad & Nadjafi-Arani, M. & Doostali, S.. (2019). Combining Topology Control and Network Coding to Optimize Lifetime in Wireless-Sensor Networks. *Computer Networks*. 162. 106859. 10.1016/j.comnet.2019.106859.
2. Khalily-Dermany, Mohammad & Nadjafi-Arani, M.. (2019). Mathematical Aspects in Combining Network Coding With Transmission Range Adjustment. *IEEE Communications Letters*. PP. 1-1. 10.1109/LCOMM.2019.2924625.
3. Klavlar, Sandi & Nadjafi-Arani, M.. (2017). Partition distance in graphs. *Journal of Mathematical Chemistry*. 10.1007/s10910-017-0781-5.
4. Khalily-Dermany, Mohammad & Nadjafi-Arani, M.. (2017). Itinerary Planning for Mobile Sinks in Network-Coding-Based Wireless Sensor Networks. *Computer Communications*. 111. 10.1016/j.comcom.2017.07.001.

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