Convergecast Scheduling Problem on a Square Grid with Obstacles

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In the wireless networks the data collected by the devices should be aggregated in the base station (BS). Aggregation time, i.e. a period during which the data from all network elements fall in the BS, is the most important criterion in the quick response networks. In the formulations of the aggregation problem the volume of the transmitted data, as usually, does not taken into account. Each packet is transmitted along any edge of communication graph (CG) during one time round (slot).

In the majority of the wireless networks, an element (vertex or node) cannot transmit and receive packets at the same time (half duplex mode), and a vertex cannot receive more than one packet simultaneously. Moreover, due to the need of energy saving, each sensor sends the packet once during the aggregation period. This means that the packets are transmitted along the edges of a desired *aggregation tree* (AT) rooted in the BS, and an arbitrary vertex in the AT must first receive the packets from all its children, and only then send the aggregated packet to its parent node.

In the most wireless networks, the transmitters use common radio frequency. So, if in the receiver's reception area working more than one transmitter, then (due to the radio wave interference phenomenon), the receiver cannot get any correct data packet. Such a situation is called a *conflict*.

In the conflict-free data aggregation problem it is necessary to find the AT and a conflict-free schedule of minimal length [1]. This problem is known as a Convergecast Scheduling Problem (CSP), and it is NP-hard even in the case when AT is given. In [2] a special case of CG in the form of a unit square grid, in which in each node a transmitter is located, and the transmission range of each element is 1, is considered. A simple polynomial algorithm for constructing an *optimal* solution to this problem was proposed.

In this paper, we consider the similar CG in the form of square grid but with rectangular obstacles and propose a polynomial algorithm for conflict-free data aggregation scheduling.

References

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