

SPACE SYSTEMS SYMPOSIUM (D1)  
Innovative and Visionary Space Systems Concepts (1)

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A COMPLEX OF SIMULATION MODELS FOR ANALYSIS OF CONCEPTS OF A SATELLITE  
PACKETS COMMUNICATION NETWORK BASED ON CONSTELLATIONS ON ORBITS OF  
DIFFERENT HEIGHTS

**Abstract**

Among the concepts of satellite communication systems there is a concept with intersatellite communication lines, the orbital segment of which comprises several constellations of different heights. The use of such constellations for packet data transmission makes optimization of the exchange of the load with the surface users possible, which can increase the throughput of the network.

Here we present a complex of simulation models of such a network. These models differ in the degree of detail of modeling of processes in the network. They model connections between nodes of the same constellation or between nodes of any constellation. Adaptive routing depending on the load and based on the algorithm of choosing the shortest passes is implemented. The load of a node is the filling of its buffer where packets are queuing for being sent through one of the outgoing directions. A notion of the state of the load of a node is introduced. The volume of the buffer is split into levels. The state of the load equals to the number of the highest filled-up level. One of these processes is stipulated by exchange of the payload with the surface users, the other, by exchange of the load with the neighboring nodes in the network. Modeling of the incoming load takes into account the activity of the users within the area, over which the space vehicle is passing. Modeling of transit load is based on two factors influencing density of incoming and outgoing flows. The first factor is adaptivity of choice of routes to the load in the nodes; the second is the possibility of appointing the costs of communication lines for implementing the algorithm of choosing the shortest routes with taking into account the cost of transition of information between the nodes in different segments of the network. The additional cost can be appointed as follows: 1) we can assume it equal zero (then all nodes of all segments are equal for the routing algorithm); 2) we can ascribe a constant value for each line of transition between two segments (which can be the same or different for each pair of segments of the network); 3) it may have variable value depending on the average load of the nodes in the segment of the network, to which the line leads.

With the use of developed models satellite networks with different variants of constellations of the space segment were investigated.