ABSTRACT

The thesis is presented in 68 pages. It contains 3 appendixes and bibliography of 34 references. 20 figures and 1 table are given in the thesis.

Topic relevance. The problem of distributed system state estimation is one of the central subject of dynamic system control theory. Atmosperical wave processes spatial state reconstruction based on sattelite measurements is an example of such problems. State estimation algorithm construction will allow to implement atmosphere state observation with minimal resources required. Information about atmospere state can be used for gravity waves and weather processes research. Algorithm application to more complex process models will allow to estimate Earth and Sun magnetosphere state.

Thesis connection to scientific programs, plans, and topics. The thesis was prepared according to the scientific topic «Development of complex processes interpretation mathematical methods based on approximate measurement values» (item «Development of thres-dimensional oscillations numerical model and algorithms for oscillations estimation based on linear measurements») in the Dynamic systems control department of Space Research Instinute of NAS of Ukraine and SSA of Ukraine.

Research goal and objectives. The goal of this thesis is to develop an algorithm for atmospere state estimation based on satelites measurements.

To accomplish this goal, the following objectives were reached:

– systematize existent methods for state identification problems solving;

– develop a reduced model of wave processes in atmosphere;

– develop an algorithm for state estimation based on state measurements across the line;

– perform a computational experiment for algorithm properties detection.

Object of research is wave process models, distributed systems state estimation methods.

Subject of research is atmospherical wave process model, wave process state estimation algorithm development.

Methods of research. To solve the task, the following methods were used: analytical

methods of partial differential equation solving (for analitycal solution aquiring); control theory methods (for model problem adaptation to dynamic system equation form); ellipsoid state estimation method (for state estimation algorithm construction), methods of the theory of algorithms and programming (for implementing the developed algorithms).

Scientific contribution consists of the following:

– for the first time, the task of full atmoshpere state reconstruction based on satellite measurements is set;

– reduced model for the wave process in a spherical layer is proposed;

– algorithm for state estimation of wave processes in a spherical layer is implemented;

– experimentally proved the possibility of full state reconstruction based on local measurements, accuracy of the estimation is found.

Practical value of obtained results. Algorithm for wave process state estimation is proposed, which can be used for atmosphere state estimation. Algorithm implementation can be used for determining algorithm properties and as a basic implementation for more complex model state estimation.

Approbation of the thesis results. Basic ideas and results of the research were presented at the 18-th International scientific and technical conference "System Analysis and Information Technologies" (2016) and at the 8th conference "Applied Mathematics and Computing" (2016).

Publications. Thesis results are published in 2 scientific works: «Wave process state estimation in the spherical layer based on partial measuments» in proceedings of Applied Mathematics and Computing conference (2016) and «Wave process evolution spatial pattern reconstruction in the spherical layer based on linear measurements» in proceedings of System Analysis and Information Techologies conference (2016).

Keywords: wave process, distributed system, system state identification, reduced model, ellipsoid method.