

Anton Antonenko
Professor E.A. Kyrychenko, research supervisor
M.L. Isakova , language adviser
SHEI “National Mining University”, Dnipropetrovsk

Development of Hierarchical Control Structure for Deep-Water Mining Complex

Today the mankind extracted a considerable part of minerals from the earth subsoil. First of all, reserves of minerals concentrated on land and underground do not completely satisfy requirements of the population of the planet. For this reason relevance of underwater mining as new source of minerals is growing every day. Underwater mining is a relatively new mineral retrieval process that takes place on the oceanic, sea floor. There are many different resources available for extraction, including silver, gold, copper, manganese, cobalt, and zinc. These raw materials are found in various forms on the sea floor, usually in higher concentrations than terrestrial mines. Therefore development of underwater fields is the perspective direction in the mining industry. But as it is relatively young branch it has some shortcomings. One of them is development of hierarchical structure of control for the deep-water mining complex. The structure of the system has the following elements.

The basic automation control system features: 1) Wide distances between subsystems; 2) High requirements to reliability and workability; 3) Equipment uniqueness; 4) Long duration of transient processes; 5) Working processes inertness; 6) Wide spectrum of solving problems, including adapting and optimizing.

Primary subsystems of the automation control system are: 1) Measuring-control data transfer; 2) General ship; 3) Benefication and storage of the minerals; 4) Hydraulic hoisting control; 5) Inventory control of the solid minerals; 6) Navigation; 7) Seabed harvester control; 8) Control of minerals pumping from the seabed harvester to storage bunker.

The tasks of Primary subsystems of the automation control are :1) Taking into account meteorological conditions; 2) Support of mining equipment reliability; 3) Support of automatic control system reliability; 4) Power inputs minimization; 5) Process optimization; 6) Continuous processes modeling; 7) Prediction and correction the inertial processes; 8) Regulation and stabilization of hydraulic hoisting and mining parameters.

There are three main levels to combine the control tasks with listed subsystems: Level 1. Adapting to meteorological conditions. Level 2. Reliability and workability control. Level 3. Agreement of mining enterprise sections.

The creation of automation control system is the main problem of deep-water complex development. Adapting to the available working time is a primary feature of the deep-water complex automation control system. The three-level hierarchical control structure is created to simplify the determination of the time limitations, based on an available working time.