

Abyzgildin A., Rudnev N.

Ufa State Petroleum Technological University

METHOD OF GRAPHIC MODELS FOR ANALYSIS OF COMPLEX PROCESSES IN CHEMISTRY AND REFINING

(petrochemical, chemical, object-oriented, graphic model)

INTRODUCTION

Before beginning the registration of data in an electronic kind, the preliminary processing is necessary. The computer capacity and velocity possibilities may be useful for the untreated information. The information, which is the material in our opinion, must be treated corresponding to informational technology as the common raw material. The informational technology is illustrated by an example of oil processing technological circuits assembling.

The widely used definition of the analysis of the as technical-engineer operation is a research of chemical process structure, calculation of the characteristics and figure of merits of chemical process operation, definition of influence of chemical process parameters on its characteristics.

A great number of methods of the chemical process analysis are known. By one of methods permitting to simplify the analysis of composite chemical processes is the analysis of flow diagrams of chemical processes with usage of graphic models [1]. From the point of view of existing methods the given analysis is still being elaborated on the basis of the theory of the graphs and topology and principle of decomposition.

BASIS

Recently designed method of the analysis of composite systems in USPTU by a method of graphic models allows simplifying essentially the representation of flow diagrams without loss of information. Besides, the given method is convenient for usage on computer systems.

The analysis of flow diagrams of chemical processes with usage of graphic models allows figuring the scheme of any complexity, using a minimum set of graphic primitives. Figure 1 presents the graphic model of hydrocleaning process which enters a structure of the industrial complex of Catalytic reforming - L-35-11/1000 (NOVOIL).

The detailed analysis of the chemical processes flow diagrams has shown, that constructions of flow diagram of any complexity need 4 graphic primitives for the map of flows, figure 2:

And 6 graphic primitives for the map of apparatus: columns, reactors, vessels, fired heaters or heat exchangers, apparatus for moving of materials (pumps, compressors) and mixer (mixers, distributor), pursuant to a figure 3:

According to a new way of the map the flow diagram of any complexity represents a tree - graph with apparatus, placed on branches. Any composite flow diagram can be figured by a small amount of graphic primitives, and in a computer storage it is necessary to create object model of such scheme. [2]

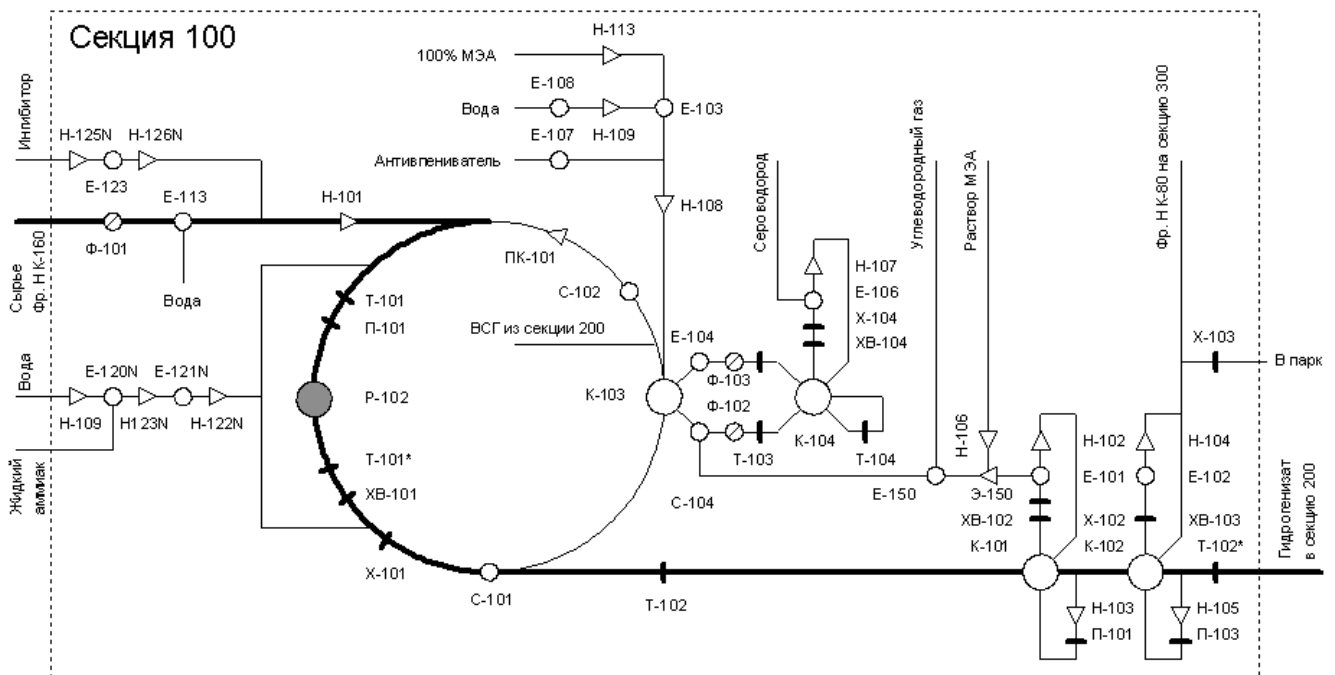


Figure 1 Graphic Model of Hydroclearing Process

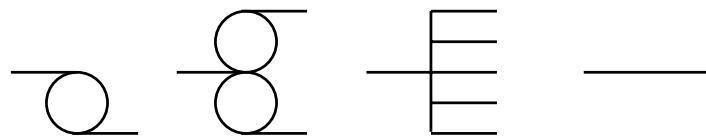


Figure 2 - Graphic Primitives For the Map of Flows



Figure 3 - Graphic Primitives for The Map of Apparatus

The object-oriented technology in computing engineering is applied from the very beginning of the 80-s and allows design the programs of any complexity. With application of the given technology the speed of software engineering has been increased greatly.

Now the most widespread and powerful method of engineering and analysis of software is based on the object-oriented concept.

At object-oriented decomposition of the world is submitted by combination of the autonomous operational agents, which interacts with another to ensure a system behavior on a higher hierarchy level. [2] Thus, each object has own behavior, and each of them models some object of an actual world. The object-oriented method of the

analysis of composite systems is possibly unique, which allows mirroring complexity and diversity of an actual world. Therefore it applies in different fields of knowledge to the analysis and designing of different systems and construction of models of dedicated areas.

The amount of problems decided with application of the object-oriented method is really wide: optimization and designing of chemical processes [4, 5], application in simulation and calculations of physicochemical properties of components [6], automation of manufacturing processes. [7]

One of the most important concepts of the object-oriented approach is the object-oriented model. The object-oriented model (OOM) is classes and objects, connected with relations between them. [3] Models are developed on the basis of principles of the object-oriented analysis. For the analysis of the dedicated area and construction of object-oriented model of chemical process flow diagram was applied the CASE package - Rational-Rose (the object-oriented analysis, designing and programming). [8]

As a notation was used Unified Modeling Language (UML) or Booch Notation. [3]

From the point of view of the object-oriented technology the analysis of chemical processes flow diagrams with the help of graphic models give:

- hierarchic structure of petrochemical production;
- a set of abstraction permitting to the expert to operate with a large array of information;
- complex representation about petrochemical plant or large industry unit;
- decomposition technique for the given dedicated area.

The overlapping of the object-oriented technology and method of graphic models allows to construct information structure for storage of any information about petrochemical processes.

Combination of a method of the composite systems analysis based on graphic models was applied for calculations, simulation and optimization of some technological clusters on the installations of catalytic reforming and hydroclearing. During this work the computer program was composed and registered. [9]

Each mathematical model of the apparatus represents a separate module and a separate object. For reusing available computational methods of mathematical models of apparatus they are integrated in stringent hierarchy of classes. The parent for all classes of mathematical models of apparatus is the general class, which contains common fields for all models and gear of interaction with the main program. All remaining modules of calculation contain or can contain any methods or algorithms, descriptions of variables, comments of variables, information about flows in apparatus.

CONCLUSION

Computations of chemical processes are not only one field of usage in petrochemical industry. This information technology can be widely used for data archiving, in automation systems, for safety arrangements and precautions. About three years the method of graphic model of chemical processes is used in education.

REFERENCES

1. Abyzgildin A.U., Abyzgildin U.M., Hafizov A.R. "About the description of technological inheriting by the way of graphs" VINITI Journal 31.10.94. - № 4264-B94.
2. Rudnev N.A., Munirov A.U., Sharafutdinov I.M., Abyzgildin A.U. "Object-oriented analysis of flow diagram of process of reforming" Theses of the reports of international scientific conference " Methods of cybernetics of chemical processes", Ufa, 1999.
3. Grady Booch "Object-oriented Analysis and Design with Applications. Second Edition" Addison-Wesley Longman, Inc., 1994.
4. An Object Oriented Framework For Process Synthesis And Optimization, E S Fraga, M A Steffens and I D L Bogle, Department of Chemical Engineering, University College London, [http:// www.ucl.ac.uk / ~ ucecesf](http://www.ucl.ac.uk/~ucecesf).
5. A process engineering information management system using world wide web technology, R. Andrews and J.W.Ponton, Department of Chemical Engineering University of Edinburgh Edinburgh, Hydrocarbon Processing April 1998 Vol. 45 No.
6. Chistiakov K.E., Kozlov A.V. "Usage of an object-oriented design for system development for properties calculation of multicomponent mixtures" Theses of the reports of international scientific conference " Methods of cybernetics of chemical processes", Ufa 1999.
7. Understanding object-oriented technology, S. T. Lange, Bellingham, Washington, Hydrocarbon Processing, August 1998 Vol. 77.
8. www.rational.com.
9. № 990857 ROSPATENT.