Creation of the catalog of the equipment, materials and data processing of project model of three-dimensional configuration of spent fuel pool cooling system in a CAD "Polynom"

Abstract—**The object of the research and modeling is a cycle of development of three-dimensional model of Spent Fuel Pool Cooling System. (SFPCS) The goal of the work is development of three-dimensional model of arrangement of the SFPCS. This article discusses a question of organization of data in a multifunctional CAD systems; methodology of constructing the model on the basis of organized by catalog of equipment and parts; life cycle the project model industrial facility; generating of reporting data based on of the project model. During the work executed PC Setup to optimize CAD "POLYNOM"of the work performed testing program and modification of the program, resulting in improved performance. Result of the work is developed by the three-dimensional model of SFPCS, piping, equipment and heating equipment catalog created on the basis CAD system "POLYNOM". CAD system "POLYNOM"was introduced into trial operation and developed by the the 3D model and a catalog of the equipment used for the design of of similar facilities.**

Keywords—*EQUIPMENT CATALOG, DATA PROCESSING, PROJECT MODEL, CAD "POLYNOM", SPENT FUEL POOL COOLING SYSTEM, SFPCS, THREEDIMENSIONAL ARRANGEMENT*

I. INTRODUCTION

Building Information Modeling (BIM) is a revolutionary technology and process that has quickly transformed the way buildings are conceived, designed, constructed and operated. BIM is a digital representation of physical and functional characteristics of a facility. A BIM is a shared knowledge resource for information about a facility forming a reliable basis for decisions during its life cycle; defined as existing from earliest conception to demolition.

POLYNOM is a new generation of design systems created on the principle BIM that makes data the center of managing facilities for their entire lifecycles. The approach ensures that POLYNOM consistently works with 3D information models throughout all stages of the lifecycle: design, construction, operation, and decommissioning. This paper describes a question of organization of data in a multifunctional CAD systems; methodology of constructing the model on the basis organized by catalog equipment and parts; life cycle the project model industrial facility; generating reporting data based on the project model.

During the research executed PC Setup to optimize CAD "POLYNOM"of the work performed testing program and modification of the program, resulting in improved performance. Result of the work is developed by the three-dimensional model of Spent Fuel Pool Cooling System, piping, equipment and heating equipment catalog created on the basis CAD system "POLYNOM". CAD system "POLYNOM"was introduced into trial operation and developed by the the 3D model and a catalog of the equipment used for the design of of similar facilities.

II. METHODOLOGY

A. POLYNOM

POLYNOM is a new generation of 3D CAD for designing complex process facilities. It assists with construction, updates drawings from as-builts, and provides information models for operations and retrofits. POLYNOM was developed specifically for designing industrial facilities that contain millions of elements. It is based on NEOLANT's own state-of-the-art geometric 3D kernel, and so it handles engineering models representing the largest facilities, easily manipulating them on the screen. It works remotely over even low-speed communication connections. The approach ensures that POLYNOM consistently works with 3D information models throughout all stages of the lifecycle: design, construction, operation, and decommissioning.

POLYNOM supports the development of design documentation involving the following disciplines:

1) Production technology.
2) Metal structures.
3) Heating, ventilation, and air conditioning.
4) Water supply and sewage.
5) Architectural and construction concepts.

POLYNOM provides the tools and functions for designing processing facilities:

1) Process equipment and pipelines.
2) Architecture and construction elements.
3) Supports and suspenders.
4) Ventilation and heating.
5) Generation of drawings and specifications.
6) Operation with laser scanning point clouds.
7) 3D symbols designer.
8) Electric trays and cables.
9) Integration with calculating complexes.

B. Spent fuel pools

Spent fuel pools (SFP) are storage pools for spent fuel from nuclear reactors. They are typically 40 or more feet (12 m) deep, with the bottom 14 feet (4.3 m) equipped with storage racks designed to hold fuel assemblies removed from the reactor. A reactor's pool is specially designed for the reactor in which the fuel was used and situated at the reactor site. An away-from-reactor, Independent Spent Fuel Storage Installation (ISFSI), such as the one located at the Morris Operation, is also sometimes used. In many countries, the fuel assemblies, after being in the reactor for 3 to 6 years, are stored underwater for 10 to 20 years before being sent for reprocessing or dry cask storage. The water cools the fuel and provides shielding from radiation.

While only about 20 feet (6.1 m) of water is needed to keep radiation levels below acceptable levels, the extra depth provides a safety margin and allows fuel assemblies to be manipulated without special shielding to protect the operators.

C. Parametric modeling

Parametric modeling is a consistent set of principles for mathematical and computer modeling of three-dimensional solids. Solid modeling is distinguished from related areas of geometric modeling and computer graphics by its emphasis on physical fidelity. Together, the principles of geometric and solid modeling form the foundation of computer-aided design and in general support the creation, exchange, visualization, animation, and annotation of digital models of physical objects.

D. Pascal Script

Parametric equipment models were written on Pascal Script. A scripting engine in Pascal Script allows to customize an application taking into account their individual needs without having to recompile it. In addition, there is a possibility update applications by just sending a new script file that could even be compiled to byte code, which cannot easily be transformed back to source code.

Pascal Script includes the following features:

- Variables, Constants
- Standard language constructs:
- Begin/End
- If/Then/Else
- For/To/Downto/Do
- Case x Of
- Repeat/Until
- While
- Uses
- Exit
- Continue
- Break

Functions inside the script

- Calling any external DLL function (no special function headers required)
- Calling registered external methods
- All common types like Byte, Shortint, Char, Word, SmallInt, Cardinal, Longint, Integer, String, Real, Double, Single, Extended, Boolean, Array, Record, Enumerations, Variants
- Allows the importing and use of classes, with events, properties, methods and constructors
- Allows the importing and use of interfaces and their members
- Allows IDispatch dynamic method invocation through Variant
- Assignment of script functions to Delphi events
- Uses byte code as an intermediate format and allows the storing and reloading of compiled scripts
- Easy to use component version
- Support for include files
- Support for compiler defines
- Capability to call RemObjects SDK Services from within scripts
- Includes a tool to create headers for importing classes and interfaces

E. Testing

Testing is executing a system in order to identify any gaps, errors, or missing requirements in contrary to the actual requirements. Testing was conducted on a personal computer that has the following characteristics:

- Processor: Intel Core (TM) i5-2410M CPU @ 2,30GGts;
- The volume of RAM - 4 GB;
- Graphics cards - NVIDIA GeForce GT 520, Intel HD Graphics Family
- Hard Disk Drives - 97.5 GB, 14.5 GB of free hard disk space and 297 GB, 252 GB of free space.
- During the tests configured as follows software:
- Operating System: Microsoft Windows 7 Professional, SP1; CAD "POLYNOM" and Project Manager

III.   EXPERIMENT

IV.   RESULTS AND DISCUSSION

V.   CONCLUSION

VI.   REFERENCES LIST