

# Research on the Product Design Based on the Environmental Analysis Model and its Application

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**Keywords:** Product design strategy; The design environment model; Holographic modeling method

**Abstract.** The heterogeneity of customers from the market starting, taking into account the transfer of buying customers in each market segment, Constraints in the customer utility (individual rationality constraint and incentive compatibility constraint) products of enterprises under the various case studies the design strategy. The research results of this paper can provide enterprises in the development and design of new products is provided in decision problems support effect theory.

## Introduction

Twentieth Century since 80 time, the comprehensive development of the global economy, the network environment has brought the change of enterprise's environment, from the past stable, predictable change static environment for increasingly complex and uncertain dynamic environment. The fast changing market and constantly subdivision, demand difference customer individualization and constitute the dynamic environment of enterprise competition. A new dynamic environment mainly include to customer orientation from the product oriented, from the single market price based competition to the comprehensive competition of multi point and multi factors. The new environment, enterprises must be based on the difference demand to design the product and organization of production, faster to meet the changing needs of customers; at the same time, along with the personalized customer demand brought about by the growing market segments, the enterprise must according to the multiple segments of the market, in product diversity, product launch time, product quality and product price to achieve optimal, so as to improve the product's market share and the market competitiveness of the enterprise.

Virtual product reflects the integration of digital model based on the nature of computer products. It can reflect the function and performance of the product is in the total life cycle, to reflect the nature of the product from a number of technical aspects and angles.

## The theory and method of holographic modeling method

The emergence of new product development theory and technology to promote the development of the product modeling technology. Holographic modeling method is based on the requirement of virtual product development technology is put forward.

The interaction of holographic modeling method for integrated survey of product model and design environment model, can reflect the comprehensive, product development and internal mechanism of the dynamic process, the holographic product model truly meet the virtual product development needs, and reflect the law and characteristics of a product model of dynamic evolution.

## The design environment model

The design of environmental element is in virtual product development, non geometric basic unit makes the virtual product to produce a predetermined function or performance. The design environment model consisting of DEU according to the certain structure level. Because of the virtual product can show its performance only when environmental factors driving and constraints, therefore establishing the design environment model is an important enabling technology in virtual product development.

The design environment model by the design environment element composition, these environmental element has three sources: the function model of the products, the product development process model and knowledge base. Accordingly, the design environment model by environmental element in three aspects: functional element composition, process element and knowledge element.

(1)Function element

It is derived from the function model, the product model of the constraints and the mapping information reflect design intent in the process of evolution. Product function model is the representation of product function and semantic and behavioral description, the design model and the function is a direct expression of product design knowledge, the design intent, it is core product intelligent design and virtual manufacturing technology. The function of the product can be decomposed into the product function structure tree decomposition, until success can unit. In the functional model in addition to including product function structure, function relationship and other information, also includes constraints and mapping relationship between function model of the product entity and the design environment model.

(2)Process element

It is non geometrical product information dynamically generated in the process of product development, including analysis of development activities for the next stage or data from other applications, and for evaluation of the product information. Process modeling is to describe the various engineering activities in the process of product, product design and processing of various results and other related information to generate these activities. The characteristics of virtual product development process are: multiple application views products using VR or simulation tools produced in various stages of design for test generation, many intermediate data. Intermediate data is generated by analysing an application view of the data, the data may be input condition analysis of other application view. The application of simulation analysis by multi view intermediate data obtained, the composition of the process meta model of the environment.

**Structure design environment model**

Through the analysis of the product development lifecycle data structure is proposed in this paper, the design environment model, as shown in figure 1. It includes physical layer, logical layer and application layer.

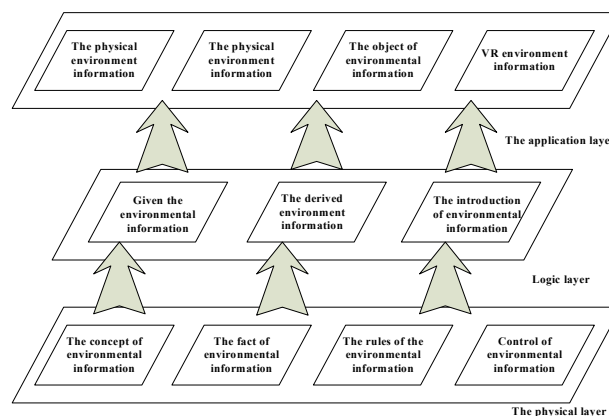


Figure 1. Structure design environment model

The physical layer

A detailed description of composition gives the design environment model of all information and storage structure. The physical layer design in environment model composed of concepts, facts, rules and control information.

Logic layer

Is integrated in all application data model of global product information model and obtain the logic model. It is the environment information according to the logic of the composition of the source representation of information.

## The application layer

Is the design environment model for specific application domain information presentation layer, is in line with the form and structure of application requirements of information model. Different applications have different needs for product information, to information and its organization mode of treatment is also different, therefore, has a different mode of information in the application layer. Some of the information the logic representation can serve many applications, but the two different application does not have information logically identical said.

## Parameter identification method of environmental model

Method for solving the inverse problem can be divided into two categories: direct method and indirect method. The direct method is the parameter as the dependent variable to solve directly, need derivative information of the whole space domain and time domain, so the application of less, more suitable for parameter identification of linear system model and computing requirements of simple cases. The indirect method is an iterative degree close to the output of the model and observed values of the optimization process by constructing a simulation based on the residual equation, if SRF value is lower than a set value, or is in an acceptable range, that the parameters are reasonable and acceptable, or adjust the parameter re evaluation, indirect the method is suitable for solving complex nonlinear system model. Review on the research of the following will focus on indirect expansion method, based on the research literature at home and abroad, the parameter identification method of environmental model can be summarized as shown in figure 2.

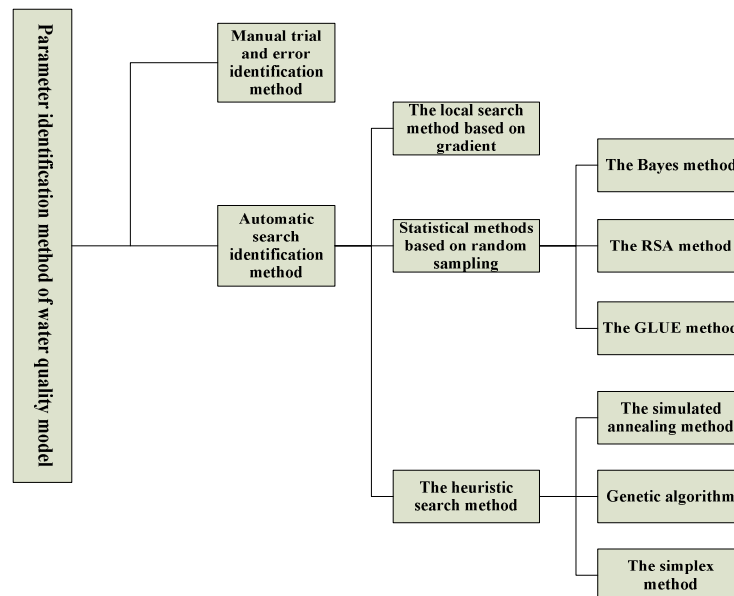


Figure 2. Classification map parameter identification method of environmental model

## Manual trial and error identification method

The method of trial and error is a method widely used in environment model parameters rate, especially when the model is complex and many parameters, it has almost become the only way of parameter calibration. The basic principle is to manually adjust the model parameter  $\beta$ , influence of simulated state variables  $C$  agreement with the observed degree  $\hat{C}$ , parameters can be optimized through drawing comparison or error calculation methods. The method of trial and error in many application environment model, such as parameters, hydrodynamic model parameters of non point source model rate rate etc.

Obviously, the trial and error method is easy to implement, a relatively small amount of calculation. But more time-consuming, and is subjective, it is difficult to quantitative measurement of parameters optimization level, difficult to answer if there are any combination of other parameters can be optimized to achieve the same level of problems

## Automatic search identification method

Automatic search method of identification is to achieve automatic search in the parameter space through a certain algorithm, and according to some optimization rules to identify the optimal or near optimal parameter set. According to the structure and search algorithm mechanism can be summarized as the local search method based on gradient method, statistical method and random sampling method based on heuristic search.

Compared to gradient based method and statistic based random sampling method and heuristic search method, the outstanding advantage is reflected in the:

The gradient searching algorithm often only can search the local optimal solution based on the initial value, has the very strong dependence, at the same time the algorithm complex structure, solving the gradient process cumbersome, not easy of use. And the heuristic search method, such as GA and SA, is a global optimization algorithm, and overcome the shortcomings of the local search method to search based on greedy thoughts, no need of special information utilization problems, such as the gradient information, strong universality, convenient implementation in practical application, especially the hybrid algorithm based on GA and SA better efficiency, global optimization. From this point, the heuristic search method is solved to some extent seek parameter optimal problem-solving parameter identification problems in traditional idea.

## Summary

This paper discusses the basic problems of the virtual product development technology, analysis of the characteristics of the development of the modeling method of virtual products. On this basis, the research and put forward the concept of holographic modeling method and design environment model and structure. The establishment of the design environment model can document and monitor the product development process, knowledge application and multi view model can be derived by various fields. So, effectively can better support the virtual product development.

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