Layout Design of Manufacturing Systems

[1]Zhao Jiang, [2]Yuhong Tai

[1]University of Shanghai for Science and Technology, Shanghai, China
[2]University of Shanghai for Science and Technology, Shanghai, China

Email: Jzgood@163.com

Abstract –The conception of multi- cell manufacturing system is proposed from the view point of layout design, and thus all lay out problems of various manufacturing systems can be converted into layout design problem of multi - cell manufacturing system, which includes two aspect s—machine layout and cell lay out . For the former conception , a solution strategy combining optimization modeling with virtual reality technique is presented; for the later aspect , an integrated layout design methodology is proposed, which includes an integrated lay out mo del and a hybrid solution algorithm.

Keywords –Layout design; Virtual Simulation; multi- cell manufacturing system

1. Introduction

Manufacturing system layout problem is a very important question. As Data shown that among the manufacturing, the total operation cost of 0% ~ 50% is material handling cost, and good layout design can make this one Cost decreased by 10% ~ 30%. In addition, the plant production activity, From raw materials to the plant products factory, material in real processing, inspection Time accounts for only of the production cycle of 5% ~ 10% and 90% ~ 95% .Time is stagnant or handling state. Good layout design can lift. High processing material efficiency, reduce in products stay, enhances the enterprise the Productivity. Therefore, for a long time, the layout of the manufacturing system has been designed as one of the most important and most difficult design task for manufacturing industry
In order to do the manufacturing system layout problems in further research Study, based on the analysis of the existing various layout method, from the viewpoint of layout design, this paper proposes the concept of unit manufacturing system, all kinds of system Build system layout problem transformation which is unit manufacturing system layout design Problems, including equipment layout and unit layout two aspects, and are given respectively Solution strategy and methods.

2. Fireflies algorithm profile

The related manufacturing system cloth Bureau design research mainly focus on Mode and algorithm field. As shown in figure 1, through the entity layout simplified, abstract set up layout Optimization model, select effective for solution algorithm optimization,

Manufacturing system layout design in the model and algorithm has many difficulty problems .Modeling including layout space, layout objects and layout of process modeling, The layout of the system would involve complicated and random geometry, involves not line Sexual numerical constraints, and can't be described constraint; Using mathematical optimization model of the description Layout problem though has been doing a simplified, still with the actual far, belongs to NP asked Problem, in limited time when algorithm cannot get the exact solution.
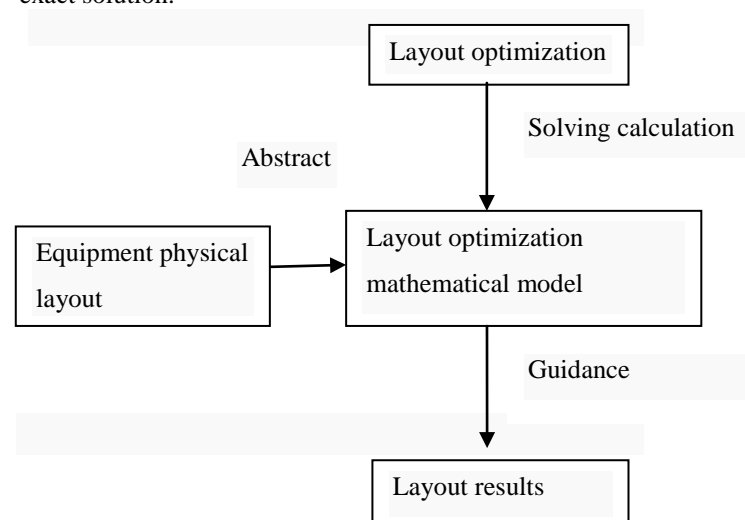

Figure1 Mathematical Modeling to Solve Layout Design

By modeling the optimal solution is a kind of sublimate process, can handle only complex layout design task of some local work, for complex Manufacturing system layout and practical engineering applications are powerless. So establish a new theoretical

framework. This paper established a kind of integrated optimization solution and virtual environment dynamic interaction of the layout of the integrated layout design framework .

As shown in figure 2, we know the basic characteristics of virtual technology, Will the reality layout environment and a layout Path through the modeling mapping to the computer Virtual environment, with the aid of related hard Pieces of equipment, to provide layout design Person a three-dimensional, interactive, Intuitive convenient man-machine interface, in virtual environment simulation of the actual layout The whole process. Above process not only To avoid the physical layout cycle is long, the high cost and low efficiency of the faults, still can fully Using design personnel's knowledge and experience to carry on detailed layout design and adjustment, Real-time and intuitive visual analysis and evaluation of the layout scheme .

Layout design as a complex combinatorial optimization problem, which involves the space geometry And logistics cost constraints. This system framework to solve the following 2 point key Technology: establishing the mathematical model and solving. The former is a hotspot of current researches fields, also made some mature research into Fruit. Here we focused on the research of the latter. Considering the practical layout of the specific process Requirements and technical feasibility of realizing, can will be based on the layout of the virtual simulation set the system refining are as follows:

1) Establish layout optimization module, the use of the integrated layout algorithm to solve layout model quantitatively, and the system of the general layout plan.
(2) With three dimensional model expression of complex layout object, and through the scene Structure model and the mutual relation, the layout of the simulation of the actual space and layout objects.
(3) To provide relevant support layout design of the auxiliary function, such as interference inspection Check, measurement function, inquires the function, etc. These measures can improve the efficiency of the layout.
(4) Establish a virtual layout environment layout constraints mechanism, such as between the equipment Minimum spacing, movement characteristics, the layout area, etc. When the system when violates the constraint to ring or color change tip.
(5) To realize virtual simulation function, the establishment of virtual scene, let the user experience true Real module layout effect. With animation form simulation layout objects move and handling Process. Here basically to some qualitative indicators to make judgment, such as the layout of the beautiful Sex, security, and the man-machine engineering factors, etc.
(6) Establish a layout scheme evaluation standard, including qualitative and quantitative criteria.

Quantitative index refers to the logistics cost and space utilization, Qualitative index refers to a clean and tidy environment, layout beautiful coordination.
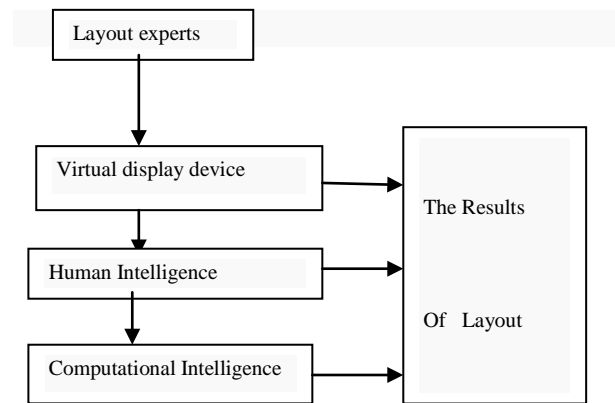

Figure 2.Virtual Environment Layout Design

3. Case

According to above virtual simulation layout design framework, we Delmia company Virtual prototype development and simulation design of the commercial software ENVISION for Basic, in view of the layout of some special requirements, through the secondary open Hair add corresponding user attributes, expand their layout functions; For optimal solution mode. So as to establish a relatively complete virtual layout design framework. Use this system layout design detailed processes as shown in figure 3.

Figure 3 Based on ENVISION system layout design

As shown in figure 5, using this system to one injection molding machine to realize optimized production workshop Change layout. First determine the process and equipment so as to determine the layout of some relevant reference Number; And by using the CAD software based on the various processing equipment geometric model, the transformation Into the VR technique model in model base; Simplified abstract mathematical model is established and call Optimization module and the equipment layout sequence; In a virtual environment from geometric die Type v in the library each layout object, according to the solution space position relations preliminary arrangement good Each object; Set up various constraints and motion relationship, active collision detection, through All kinds of interactive means detailed dynamic layout adjustment, observation layout effect; The most Through ENVISION own GSL simulation language programming scheduling each object

mode Type, the layout of the process of dynamic simulation and scene roaming.

4. Concluding remarks

This paper based on the virtual simulation of manufacturing system layout frame design. To realize this system has strong 3 d visualization layout simulation function, at the same time by In its vitalizing modular system structure, logical relationship clear, independence is strong, But according to function need any expansion, thus in the subsequent work unceasingly To improve or add new modules. This system is still there are so many places that need correspondingly to improve and added, such as between the module of data sharing and automatic conversion, etc. this

Outside, if can be in the simulation environment too much channel man-machine interface, make the layout design Personnel immersion in a virtual layout environment, will be more conducive to human's intelligence play, These are still depends on the further development of the virtual simulation technology and mature. Manufacturing system layout problem is a in system planning stage must solve the good major problem. This paper, from the point of view of layout puts forward a kind of Multiple unit manufacturing system concept, thus will all kinds of manufacturing system cloth Bureau problem for transformation of cellular manufacturing system layout design problems, it bag Doctor equipment layout and unit layout two. For the equipment layout,

This paper Will layout process is divided into general layout and detailed layout two stage, using Optimization modeling and VR technology combining the solving strategy, better solution The equipment layout of the qualitative and quantitative problem. For unit layout, This paper, from the point of view of integrated design, the integrated layout design method, Effectively solve the manufacturing system of unit layout and logistics path set Meter problem.

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Vitae

Zhao Jiang, Was born in 1986.He obtained a Bachelor degree in Engineering management in Civil engineering college from Jiangsu University of Technology and Science. He now is a student in University of Shanghai for Science and Technology, Shanghai, China. His research is industrial engineering.

Yuhong Tai is an associate professor from Shanghai University of science and technology, her research direction is project management.