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RESEARCH ARTICLE

Evaluation and Enhancement of Transfer line in Production Process by Simulation

Kuldeep Kumar Verma, Vivek Babel

Department of Mechanical Engineering, RGPM, Bhopal

*Corresponding Author E-mail:

ABSTRACT:

Plant Simulation software enables the simulation and optimization of production systems and processes. Using Plant Simulation, you can optimize material flow, resource utilization and logistics for all levels of plant planning from global production facilities, through local plants, to specific lines. In times of increasing cost and time pressures in production, along with ongoing globalization, logistics has become a key factor in the success of a company. The need to deliver JIT (just-in-time)/ JIS (just-in-sequence), introduce Kanban, plan and build new production lines and manage global production networks (to name a few) requires objective decision criteria to help management evaluate and compare alternative approaches. Plant Simulation helps create digital models of logistic systems (e.g., production) to explore the systems' characteristics and to optimize their performance. The digital model enables users to run experiments and what-if scenarios without disturbing an existing production system or – when used in the planning process – long before the real system is installed. Extensive analysis tools, statistics and charts let users evaluate different manufacturing scenarios and make fast, reliable decisions in the early stages of production planning. Plant Simulation helps users to Detect and eliminate problems that otherwise would require cost- and time consuming correction measures during production ramp up Minimize the investment cost of production lines without jeopardizing required output, Optimize the performance of existing production systems by taking measures that have been verified in a simulation environment prior to implementation.

KEYWORDS: SIM, PLM, Transfer Line, Production.

I. INTRODUCTION:

In the contemporary, dynamic changing world, access to production data in real life is necessary to properly plan, simulate and supervise production. Companies operating in different sectors of the economy are more and more commonly using IT solutions to optimize logistic systems by improving the handling of materials and performance parameters. Computer simulations are the techniques and tools most frequently used in broadly understood production engineering, logistics or industrial engineering.

Along with the technological progress in the field of information technology and very rapid enhancing computing power, increases also the popularity of methods based on computer simulation. Moreover, to follow the technological and economic changes and dynamic developing global trends, the companies must react in a cost-effective, efficient and fast way. To remain competitive, companies must design manufacturing systems that not only produce high-quality products at low costs, but also allow for rapid response to market changes and consumer needs.

Identifying errors in the planning phase is much cheaper for a company than doing that after the start-up of a project or its full implementation. Performing a computer simulation makes it possible to assess whether the project was designed properly and is being carried out as it should. Simulation provides a comprehensive perception of the

studied process or product, allows to conduct multi-criteria analysis, and to test many scenarios. That is why computer systems are becoming necessary tools which support the design and improvement of business processes.

The terms “simulation” and “model” are often used in the work, hence it is necessary to provide their definitions. Simulation is a representation of a real system including its dynamic processes in a digital model, allowing the transfer of conclusions to the reality. In a broader meaning, simulation means the preparation, implementation and evaluation of specific experiments with the use of a simulation model. Model is a simplified copy of a planned or real system, including its processes, in another system.

Regarding simulation, it is recommended to apply the following methodology presented at the Figure 1:

Figure 1: The methodology of conducting simulation

Thus, computer simulations should be understood as methods which allow to test the planned solutions in a digital, virtual model before they are implemented in the real world. The article discusses the possible applications of Tecnomatix Plant Simulation software to simulate production processes and emphasizes the advantages of applying such simulations. It also introduces some integrated optimization tools and advanced analytic tools to optimize the throughput and operation of production plants and individual logistics processes and minimize work-in-process.

Tecnomatix Plant Simulation is an object-oriented 3D program used to simulate discrete events, which allows to quickly and intuitively create realistic, digital logistic systems (e.g. production) and thus test the properties of the systems and optimize their performance. The application is manufactured by the German company Siemens PLM Software, which is the leading global supplier of software for PLM (Product Life-cycle Management) and MOM (Manufacturing Operations Management). The solutions provided by Siemens as part of Smart Innovation Portfolio help production companies optimize digital enterprises and implement innovations. Digital models make it possible to perform experiments and test “what if” scenarios without disturbing the work of production systems or, in the case of the planning process, long before their assembly. Preliminary definition of the libraries of factory and logistic facilities makes it possible to create simulation models in an interactive way.

Advanced analytic tools, such as bottleneck analysis, statistics and charts, can be used to evaluate different production scenarios. The results ensure information necessary for quickly making good decisions at early stages of production planning. In addition, this way it is possible to optimize material flow, the use of resources and logistics at each level of planning – beginning with global production facilities, through local enterprises, up to individual lines.

Tecnomatix Plant Simulation application is available in: English, German, Japanese, Hungarian, Russian and Chinese. It is also possible to efficiently switch from one language to another. A very important feature of the program is the possibility to model and simulate processes following the paradigms of object-oriented programming. The following features of such programming need to be mentioned:

- Inheritance – it is possible to create new classes on the basis of existing ones. The original class is called the base class, and the derivative one is the subclass. This property is important e.g. when designing a production hall. If several machines (workstations) are of the same type and have the same properties, then instead of defining each

of them individually, we can only define the base machine (base class), and define the settings of the other machines (subclasses) by inheriting the properties from the base class.

- Polymorphism – classes and methods may be redefined, which allows to build complex models with a very transparent structure in a quick and simple way;
- Hierarchy – complex models can be designed on several logically connected levels (working windows). This property enables to implement two most popular strategies used in information processing and design: “Top-Down” and “Bottom-Up”.

Figure 2: Idea of bottlenecks

Tecnomatix Plant Simulation provides effective and simple analytic tools which allow the detection of bottlenecks (Bottleneck Analyzer), tracking material flow (Sankey Diagrams) and identification of resource excess (Chart Wizard). A very important advantage of this program from the point of view of the author's scientific interest is that it provides integrated optimization tools.

These include mainly:

- GA Wizard – an optimizing simulation model using genetic algorithms;
- Layout Optimizer – which enables minimizing transportation costs using genetic algorithms;
- Neural Network – which makes it possible to identify connections between input and output parameters and which provides projections with the use of artificial neural networks;
- Experiment Manager – used to create scenarios or evaluate relations between two input parameters.

Tecnomatix Plant Simulation allows also performing statistical data analyses (e.g. studying dependence and independence, regression, data fitting, ANOVA etc.). Furthermore, it is possible to import data from other systems, programs or databases, e.g. Access, Oracle, Excel, SAP, and AutoCAD. A very important advantage of the program is also the tool used for original algorithms and scripts programming (Method). The built-in language SimTalk, with the syntax based on Basic, is used for this purpose.

RESEARCH METHODS:

Studying phenomena and processes is the aim of many research programmes. This involves the application of various methods, beginning with practical activities in the form of observations, and ending with theoretical analyses. Such procedures require a mathematical apparatus. In the contemporary world dominated by ICT tools, a computer simulation becomes an exceptionally significant and effective research method. It reflects the studied phenomenon or a process in the form of a computer program, also called a computer model, which is created with the use of a mathematical model.

Simulation is an approximate imitation of a studied phenomenon or behaviour of a given system in the virtual space with the use of its so-called simulation model. A simulation model is based on a mathematical model frequently recorded in the form of a computer program. At present, many tools are available for conducting computer simulations that allow creating simulation models. Simulation models are used to reduce the risk of failure while implementing significant changes into the existing manufacturing systems. Upon generating the model, a simulation analysis is performed to determine particular elements of the process. The model of a studied system presents its properties, features and limitations as well as the manner in which the process in specific conditions takes place. Simulation, by means of adequate tools, allows for a respectively simple and cheap way of verifying different variants connected with the functioning of the processes.

With a view to the objective of the simulation, it can be divided into three types:

- A simulation aimed at understanding the principles of the functioning of the system and its properties that are difficult to distinguish based on a formal analysis;
- A simulation aimed at facilitating decision making within the functioning of the system;
- A simulation, whose aim is to train decision makers concerning the functioning of the system. The simulation of production processes is a technique used for solving problems occurring during the manufacturing process. It is based on virtual models. As a method, a computer simulation is a system of research activities, i.e. a structure of stage activities aimed at achieving a research objective. The creation of a simulation model of a process is a multi-stage task. Figure 3 presents the seven-step approach to conducting a successful simulation study.

Modelling the production process involves the creation of a virtual manufacturing process that allows conducting a simulation and collecting statistics. Statistics facilitate conducting reports and comparing selected settings of the parameters that characterise workstations. Computer models can be freely improved, and further simulations can be applied to various variants and settings anticipated by the user.

II. RELATED WORK:

LIU Xuemei et. al. [2017] [1]:

The transfer line balancing problem (TLBP) and the buffer allocation problem (BAP) are amongst the most studied problems on transfer line system. However, the two problems are usually solved separately, although they are closely interrelated. Traditional optimization of TLBP probably leads to a deviation of production rate from the actual performance which is used as the optimization objective of the following BAP, especially when the equipment reliability differences are relatively large. In this paper, an innovative approach, considering machining accessibility and machine reliability, is presented to solve the TLBP and BAP simultaneously. A polychromatic-set-based constraint model and a collaborative optimization algorithm are proposed. A group of Boolean constraint matrixes both for machining feature sets and their optional stations sets are constructed through polychromatic set theory. A new coding mode based on priority, which always keeps all schemes feasible in each iteration and suitable for GA, PSO and other intelligent algorithms, is presented to describe all the allocation information for station, process, buffer and configuration. Optimization objectives including production rate and production cost are evaluated through the COM interface with simulation software. Comparison experiments and a real case of a diesel engine block demonstrate both the validity and efficiency.

Dušan Sabadka et. al. [2017] [2]:

Manufacturing companies are now placing great emphasis on competitiveness and looking for ways to utilise their resources more efficiently. This paper presents optimum efficiency improvement of the automotive transmission assembly production line by using line balancing. 3 assembly stations were selected to optimize where waste management requirements are not met for achieving the production capacity. Several measures were proposed on the assembly lines concerned to reduce operations by using eliminating unnecessary activities of the assembly processes, reducing the cycle time, and balancing manpower workload using line balancing through Yamazumi chart and Takt time. The results of the proposed measures were compared with the current situation in terms of increasing the efficiency of the production line.

P. Duda et. al. [2017] [3]:

The XATL1 cryogenic transfer line for XFEL/AMTF is dedicated for transferring cryogenic cooling power from helium refrigerators to a cryogenic test facility by means of the continuous flows of cold helium in supercritical and gaseous state. The external envelope of the transfer line contains 4 cold process lines and a common radiation shield, as well as the system of supports and thermal contraction compensators. The XATL1 was designed and manufactured within the Polish in-kind contribution to the XFEL project. The line has been under operation since year 2012. The paper presents a design, including supporting and thermal compensation systems, of the XATL1 line. The line performance analysis based on the Second Law of Thermodynamics has been done, and the output has been compared with the design assumptions.

Maria Estela Peralta Alvarez et. al. [2016] [4]:

The studies about sustainable manufacturing engineering (SME) contain an increasing body of knowledge, motivated by the rising interest in the processes lifecycle sustainability. Its continuous improvement and

optimization (including sustainability criteria) has become an emerging necessity. For this reason, new clean technologies and proposals of work methods are required; they have to integrate the ecological and social dimensions at an operational level in the manufacturing processes, maintaining the economic and technical feasibility attained up to this moment. However, a unified framework does not exist to orientate the lines of research in optimization when applied to sustainability. In this sense, the article reviews studies from scientific literature about sustainable machining developed in the last 15 years. The review has been carried out from the triple bottom-line (TBL) perspective, defined by the three general sustainability dimensions (economy, ecology, and equity). It contributes to the literature and current machining engineering knowledge, with its involvement in mitigating the metabolic rift. The results from the review have allowed to characterize the investigation effort, with regard to the optimization of the sustainable machining processes; even though numerous studies exist which optimize machining operations (with the aim to find the trade-off between different environmental and equity factors), in general, the technical and economic feasibilities are still the priority. The patterns defined through the analysis of the publications have established the current development trend; furthermore, as a consequence of the review results, we propose an outline of articulated lines of investigation with the aim to mitigate the metabolic rift through triple bottom-line, necessary so that machining engineering assumes the goal of finding the balance to achieve integral sustainability.

Nikola Gjeldum et. al. [2016] [5]:

Croatia's manufacturing industry faces many problems and obstacles that have a large impact on its competitiveness. Insufficiently educated and unskilled personnel, particularly in the production and management fields, are decreasing competitiveness that is necessary for survival in the global market. Objective of project Innovative Smart Enterprise is to establish a special learning environment in one Laboratory as Lean Learning Factory, i.e. simulation of a real factory through specialized equipment. The Lean Learning Factory's mission is to integrate needed knowledge into the engineering curriculum. Therefore, Lean Learning Factory at University of Split is in continuous developing process to support practice-based engineering curriculum with possibility of learning necessary tools and methods, using didactic games or real life products and equipment. Solution proposal for best balance between toys and real products consider design and production line development for product Karet. It is a traditional and original product from Croatia, so it will raise enthusiasm in learning process in both students and industry employees. Two assembly lines will be developed, one traditionally equipped and one intelligent, networked, flexible, and fully improved by Lean tools. By deeper analysis of both assembly lines, hybrid assembly lines could be designed, to balance on one side assembly tact time according to customer demand and total cost of installation and running on the other side. Methods and tools adapted and implemented, in both design and analysis process for optimization of this hybrid assembly line would be scaled and adjusted for industry use as part as knowledge transfer from university to enterprises.

Khaleel Al ithawi et. al. [2016] [6]:

Throughput, equipment utilization and costs reduction are critical factors to be considered in a highly competitive environment, especially when the demands of variety of aluminum engine blocks have been increasing rapidly. Flexible Manufacturing System (FMS) is designed to achieve the key of cost effective production because it is a very good combination between variety and productivity. FMS is a system which consists of too many programmable machines that connected by an automated material handling system to produce a very wide variety of products. Correspondingly, the cost for building a new FMS is positively correlated with its flexibility. For that cause, the design of FMS requires an intensive effort on designing, analyzing and optimizing. The aim of this project is to build a simulation model of new manufacturing system for new plant to produce 1200 engine components per day. This system should be flexible, reliable and within maximum scrap rate % 1. Furthermore, the optimization and analysis of production performance measures which are inclusive of cost, machine utilizations, and jobs per hour help the company studying the system and selecting optimal scenario as well as to support upper management to make perfect decision before implementing a new system. The methodology used in this study is simulation modelling which is presented as a powerful technique that can apprehend the complexities of the FMS. Arena software has been used to propose all scenarios. Results show that optimal scenario 3 can increase the throughput by %16 jobs per year.

Miroslav MUSIL et. al. [2016] [7]:

Application of the simulation tools within the framework of a large spectrum of various logistic processes is becoming a common obviousness on the present. The simulation tool enables to obtain such information, which is unidentifiable in the current practice, however this information is a valuable informational source for a following evaluation of the logistic processes. This article presents analysis of a logistic system using the simulation model created by means of the software product Tecnomatix Plant Simulation.

Mateusz Kikolski [2016] [8]:

The problem of bottlenecks is a key issue in optimising and increasing the efficiency of manufacturing processes. Detecting and analysing bottlenecks is one of the basic constraints to the contemporary production enterprises. The enterprises should not ignore problems that significantly influence the efficiency of the processes. People responsible for the proper course of production try to devise methods to eliminate bottlenecks and the waiting time at the production line. The possibilities of production lines are limited by the throughput of bottlenecks that disturb the smoothness of the processes. The presented results of the experimental research show the possibilities of a computer simulation as a method for analysing problems connected with limiting the production capacity. A computer-assisted simulation allows for studying issues of various complexities that could be too work-consuming or impossible while using classic analytical methods. The article presents the results of the computer model analysis that involved the functioning of machinery within a chosen technological line of an enterprise from a sanitary sector. The major objective of the paper is to identify the possibility of applying selected simulation tool while analysing production bottlenecks. An additional purpose is to illustrate the subjects of production bottlenecks and creating simulation models. The problem analysis involved the application of the software Tecnomatix Plant Simulation by Siemens. The basic methods of research used in the study were literature studies and computer simulation.

Julia Siderska [2016] [9]:

The main objective of the article was to present the possibilities and examples of using Tecnomatix Plant Simulation (by Siemens) to simulate the production and logistics processes. This tool allows to simulate discrete events and create digital models of logistic systems (e.g. production), optimize the operation of production plants, production lines, as well as individual logistics processes. The review of implementations of Tecnomatix Plant Simulation for modeling processes in production engineering and logistics was conducted and a few selected examples of simulations were presented. The author's future studies are going to focus on simulation of production and logistic processes and their optimization with the use of genetic algorithms and artificial neural networks.

Peter Malega et. al. [2015] [10]:

This paper contains the description of the production process and the simulation in Plant Simulation. It also contains the description of the steps, which are necessary to create the simulation of the production process with the pictures directly from Plant Simulation.

Fatme Makssoud et. al. [2014] [11]:

The paper deals with a transfer line reconfiguration problem. Such lines are made of machines (workstations) located in sequence and linked by a material handling device. Each machine can be equipped with several multi-spindle heads activated sequentially. Each spindle head executes a set of operations simultaneously. If new products have to be manufactured at the line or existing products are modified, then the line has to be reconfigured in order to meet new production requirements. The objective of such reconfiguration is to reduce the investment cost for new equipment by reusing optimally the existing facilities. A new mathematical model is suggested for this optimization problem. A case study is presented to demonstrate the use of the developed optimization model. The results of numerical experiments for 41 industrial test problems are also analyzed which show that up to 51 % investment savings can be obtained with this model.

Robert J. Riggs [2014] [12]:

Remanufacturing is a promising product recovery method that brings new life to cores that otherwise would be discarded thus losing all value. Disassembly is a sub-process of remanufacturing where components and modules are removed from the core, sorted and graded, and directly reused, refurbished, recycled, or disposed of. Disassembly is the backbone of the remanufacturing process because this is where the reuse value of components and modules is realized. Disassembly is a process that is also very difficult in most instances because it is a mostly

manual process creating stochastic removal times of components. There is a high variety of EOL states a core can be in when disassembled and an economic downside due to not all components having reuse potential. This work is focuses on addressing these difficulties of disassembly in the areas of sequence generation, line balancing, and throughput modeling.

Marek Kliment et. al. [2014] [13]:

In this paper we focus on analyzing the production process using the selected module Siemens PLM namely Module Tecnomatix Plant Simulation. Apply it in the analysis of the production process the production company. We focus on the proposal of optimization measures proposed in that software package. At the beginning of the clarify and mentioned some theoretical notions, but the essence of the paper is devoted to the analyzed and designed simulation model. The result of analysis and design is a graphical solution of the original and proposed situation in the company.

M. Chorowski et. al. [2012] [14]:

Liquid gases distribution system is an unavoidable element of practically each high capacity cryogenic installation. It comprises transfer lines, which in spite of their first view simplicity, are complex parts of the system, relevant both for its thermodynamic efficiency and its reliability. The presently constructed transfer lines may comprise several process pipes filled with different fluids at different thermodynamic parameters. The heat that inflows to cold process pipes influences significantly the thermal budget of the cryogenic system and consequently the required supply power of the refrigerator. Transfer lines are multi-dimensional, thermo-mechanical objects that can be thermodynamically optimized with entropy generation minimization, based on the Second Law of thermodynamics. The paper presents two practical examples of a simple and complex transfer line optimization. The lines are split into a number of constructional nodes which enables one to calculate the entropy generated in elementary heat transfer and fluid flow processes. The presented examples show that the Second Law analysis can help in identifying the constructional nodes which are responsible for high rate of entropy generation and the method enables constructional and engineering decisions.

B. FINEL et. al. [2008] [15]:

The optimal logical layout design for a type of machining transfer lines is addressed. Such transfer lines are made of many machine-tools (workstations) located in sequence. On each workstation there are several spindle-heads. A spindle-head does not execute a single operation but a block of machining operations; all operations of a block are executed simultaneously (in parallel). Spindle-heads of the same workstation are activated sequentially in a fixed order. The transfer line design problem considered in the paper consists of finding the best partition in blocks and workstations of the set of all operations to be executed on the line. The objective is to minimize the number of spindle-heads and workstations (i.e. transfer line investment cost). An optimal decision must satisfy a desired productivity rate (cycle time) as well as precedence and compatibility constraints for machining operations. A heuristic algorithm is proposed: it is based on the COMSOAL technique and a backtracking approach. Results from computer testing are reported.

Kuldeep Kumar Verma et al [2018] [19]:

discussed about different bottleneck balancing problem, process planning and line configuration. For optimize bottleneck is must to be design features of the product are grouped and machining operations are sequenced in an optimal manner. The objective is to find out problem and possible solution on the handling time fraction of the cycle time consisting mainly of orientation change time and tool change time in different bottleneck sequencing, which is used by industrial production.

III. PROPOSED WORK:

Siemens Tecnomatix- Tecnomatix is a comprehensive portfolio of digital manufacturing solutions that deliver innovations by linking all manufacturing disciplines together with product engineering from process layout and design, process simulation and validation, to manufacturing execution. Tecnomatix is built upon the open Product Lifecycle Management (PLM) [4].

The Product Lifecycle Management provides access to product and process knowledge in the frame of the whole life cycle of a product (conception, design, manufacture, transportation, utilization, disposal, recycling). The PLM is

originally based on Computer-aided Design (CAD), Computer-aided Manufacturing (CAM) and Product Data Management (PDM).

Tecnomatix is a part of the Siemens PLM Platform (Figure 2) and it is categorized into groups such as:

- Part Planning and Validation - Part Manufacturing Planner, Machining Line Planner, Press Line Simulation, Virtual Machine Tool
- Assembly Planning and Validation - it is exploited in Process Designer, Process Planner, Process Simulate Assembly, Process Simulate Human, Jack (Control of assembly processes, ergonomics, etc.)
- Robotics and Automation Planning - it is exploited in Process Designer, Process
- Simulate Robotics, Robcad, Process Simulate Spot Weld (Robotic production process, etc.).
- Plant Design and Optimization - it is used in Factory Cad, Factory Flow, Plant Simulation (Optimization of production processes, etc.).
- Quality and Production Management - Dimensional Planning and Validation (DPV), Variation Analysis (VSA), CMM Inspection, Manufacturing Execution Systems (MES), HIM/SCADA

Figure 3: Portfolio of a digital factory

The First category surfaces data link and rough planning via Process Designer or TCM Process Planner. The second category surfaces simulation and detailed planning via Process Simulate Assembly, Process Simulate Robotics or Robcad, Process Simulate Human or Jack. The third category surfaces design and optimization via Factory CAD, Factory FLOW and Plant Simulation.

Software Factory CAD is a superstructure of AutoCad. We can use it to a quick modeling of a 3D layout of production and to project production halls, workstations etc. Factory FLOW is also a superstructure of AutoCad. We use it to representation of a material ow, graphical and numerical cost of transportation of individual variants etc. Plant Simulation is suitable for optimization of industrial factory processes in 2D layout. It contains dynamical simulation, exploiting of people and machines, identification of thin places in workstation, transport of supply, verification of strategies, occupancy of stores, optimization of production processes, etc.

Software Process Designer serves as a rough planner for operations, resources and products used in 3D simulation, balancing of product lines, etc. On the other hand Process Simulate serves as a detail planner for accurate analysis, simulation of operations, collision planning, time analysis, ergonomic analysis, Offline Programming of Robots (OLP), Virtual Commissioning (VC), etc.

INVESTIGATE:

When modelling a system of processes, a crucial part of the model is the data used. It is the data that fuels the model, hence if the data does not represent the modelled system well, the worthiness of the model's result is endangered. When modelling a manufacturing system, Bangsow suggests collection of the following data:

- Factory structural data (e.g. layout, means of productions, restrictions) Manufacturing data (e.g. use time, performance data, capacity)
- Material flow data (e.g. topology, conveyors, capacities)

- Accident data (e.g. functional accidents, availability)
- Organizational data (e.g. break scheme, shift scheme, strategy, restrictions)
- System load data (e.g. production orders, BOMs, working plans, volumes, transport)

Figure 4: Tecnomatix groups according to use

SIEMENS PLANT SIMULATION:

A part of the investigation process was to familiarise with simulation program used, namely Siemens Plant Simulation. Two weeks were set aside to learn the program and to study its components. The program contains tutorials, which were completed before the “real” simulation began. On the Internet there also exists a community page where Plant Simulation users can discuss problems and help each other out. (Figure 4).

Figure 5: Technomatix plant simulation 13

Figure 6: Tool Bar of Technomatix Plant Simulation 13

IV. RESULT ANALYSIS:

After process analysis for the current process plan of the company, identified some spaces where we were having chance for improvement. From that we reach to the conclusion, some modifications are required in the process plan, current plant layout with the help of which we can improve the productivity upto satisfactory requirement. Main part of the research is related to the study of methodologies used currently, working conditions with which staff is working as well as the material handling map for the jobs inside the premises of company which is used for the job from raw material to finished goods. While doing this we did the study for each machine operation by using the techniques of method study and time study which are related to the subject of industrial engineering. In that we considered each part involved in machining process like job setting time, tool setting time, CNC program setting time, CNC program running time, speeds, feeds, depth of cuts used for the every operation, tool life, tool changing time, job unloading time etc. Primary aim of our project is to improve the productivity and the reduction in job manufacturing cost. Our project is basically study based project. Productivity improvement is the key to improve the profit of company as well to generate better and better working conditions for the operators working at shop floor. Thus improvement in system leads to good results for company.

OVERVIEW:

The result obtained from production failure investigation in many areas and identify is a consequence of investigation by plant simulation tool and considering real environment of transfer line.

Single Transfer Line for Multiple Operation

Single Transfer Line for Multiple Operation with Framework

Graph on Parallel or Mixed Transfer Line for Multiple Operation

Parallel or Mixed Transfer Line for Multiple Operation with Single Buffer

Parallel or Mixed Transfer Line for Multiple Operation with Multiple Buffer

Parallel or Mixed Transfer Line for Multiple Operation with Multiple Buffer

Parallel or Mixed Transfer Line for Multiple Operation with Multiple Buffer and experimental setup

Parallel or Mixed Transfer Line for Multiple Operation with Bottleneck Analysis and Multiple Single Process

In a simple production line (transfer line) a model is created in simens technomatrix plant simulation where it observe the analytical results to improve the real environment in the production line as shown in above.

V. CONCLUSION:

Plant Simulation simulations are used to optimize throughput, relieve bottlenecks and minimize work-in-process. The simulation models take into consideration internal and external supply chains, production resources and business processes, allowing you to analyze the impact of different production variations. You can evaluate different line production control strategies and verify synchronization of lines and sublines. The system lets you define various material flow rules and check their effect on the line's performance. Control rules are chosen from libraries and may be further detailed to model highly sophisticated controls. The Plant Simulation experiment manager

allows you to define multiple experiments at one time, providing an efficient way to analyze and optimize your system. Based on user-defined parameters, Plant Simulation executes different simulation runs and provides you with the results of these experiments. Plant Simulation analysis tools allow for easy interpretation of simulation results. Statistical analysis, graphs and charts display the utilization of buffers, machines and personnel. You can generate extensive statistics and charts to support dynamic analysis of performance parameters including line workload, breakdowns, idle and repair time and proprietary key performance factors. At the click of a button, Plant Simulation's bottleneck analyzer shows the utilization of resources, thus indicating bottlenecks as well as underworked machines. Material flow may be visualized in a Shunky chart that, at a glance, shows transport volume in the context of the layout. Plant Simulation also generates a Gantt chart of the optimized production plans that can be modified interactively.

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