CYIENT



MANUFACTURING PROCESS OPTIMIZATION BY INTEGRATED PROCESS SIMULATION (IPS)

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Abstract

Integrated Process Simulation (IPS) is a method designed to help the process planning team to simulate the manufacturing process step by step and link all planning activities with a single source of input.

Key activities:

- Manufacturing Operation Sketches
- NC programming
- Tool designing
- Integration with ERP Application
- Change Management



In this method, a 3D model is created for each manufacturing operation, representing the exact condition of a part in that operation. Each model is linked to the previous operation model, so that any changes in one operation will propagate to subsequent operations automatically. This method can be used with any CAD tool available in the market.

Introduction

Productionizing a manufacturing process without understanding the outcome is a highly risky method. This risk can be mitigated with simulation of the process using CAD/CAM tools. Integrated Process Simulation (IPS) aims to simulate the entire manufacturing process, step by step, with utmost accuracy.

Changes are common in manufacturing. Be it part design or manufacturing process, there will

always be changes to improve performance and durability. Managing changes with ease is the most challenging task in the industry. Introducing engineering changes in the production line is especially risky as improper change management will lead to the scraping of parts. With the IPS method, we can clearly see the impact of changes made as each operation is linked to others.

The IPS Method

Since the main goal of the IPS method is to simulate the manufacturing process, a 3D replication of the product at each operation is created. To achieve this, a process planner will build a 3D structure starting with a raw material 3D model. For the next operation, another 3D model will be created by removing material per process plan. But this 3D model is linked to the raw material 3D model. This sequence of material removal by linking it to the previous operation will continue till the last operation, in which the final product is created. If we want to change any one operation and see the impact on other operations, it is very easy, as all the 3D models are linked to each other. Changes will automatically propagate to subsequent operations.



Integration with Other Planning Activities

A process plan alone will not suffice for producing a part. Operations sketches need to be drafted, tools and fixtures need to be designed, and NC programs need to be prepared in line with the process plan. Also, these tools and programs must be simulated virtually. Then we will be able to run the production line with more efficiency and can avoid scraping of parts.

Since we create separate 3D models for each operation in IPS, it becomes the single source of input for drafting operation sketches, designing tools, and preparing NC programs.

Manufacturing Operations Sketches:

Detailed instructions to the operator are the key to success of the production line. If the instructions are not clear, there is a risk of delays in production and scraping of parts.



OPERATION.30

Integrated Process Simulation (IPS) | Whitepaper

Example

Here is a visual example of IPS with the CATIA tool:



Integrated Process Simulation (IPS) | Whitepaper









Changes in raw material referring to updates in linked operations

Change Management in the IPS Method

Ease of change management is the key objective of the IPS method. Strong version control will enable users to not miss any change and roll back whenever required. Also, as the 3D structure is built based on a bottom-up concept, the impact of changes is highly visible. With version control, we can make sure there is no impact on shopfloor production while implementing and testing changes virtually.



IPS Advantages

IPS is a flexible and user-friendly tool which can easily be modified per additional requirements as needed. This tool assists in handing large and complex assemblies, and greatly reduces the time required for execution of Manufacturing Operation Sheets. IPS not only allows updating the links between different files but also helps in elimination of repetitive tasks such as balloon creation, sequence numbering, and creating modifiers for dimensions in MOS. Since the customer is upgrading all methods to Enovia PLM, applicants can fix/solve any technical issue where and when required related to IPS- CATIA.

Applicability

The IPS method can be used in any industry with any manufacturing method. Almost all CAD tools (CATIA, NX, ProE, etc.) available in the market are compatible with designing a manufacturing process using the IPS method.





Conclusion

Effective manufacturing process management will help businesses grow and discover innovative manufacturing processes. IPS is one such method to determine an optimized and robust process plan. It can be used in any kind of manufacturing environment. It offers several advantages, saves effort, reduces wastage in the process, and facilitates easy change management.

As an engineering service provider, Cyient has handled several challenges using the manual

approach, including preparing operation sheets, huge manual effort, errors in the plan, and the tedious task of identifying the errors. IPS has become a single, easy solution for all these challenges. It is presently used in organizations like Pratt and Whitney. In future, this method could evolve into a complete 3D model-based process simulation to instruct operators in the shop while manufacturing.

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About Cyient

Cyient (Estd: 1991, NSE: CYIENT) is a global Engineering and Technology solutions company. We collaborate with our customers to design digital enterprises, build intelligent products and platforms and solve sustainability challenges. We are committed to designing tomorrow together with our stakeholders and being a culturally inclusive, socially responsible, and environmentally sustainable organization.

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