ITC INFOTECH

Business-friendly Solutions

PRODUCT VALIDATION FOR HI-TECH INDUSTRY

PREFACE:

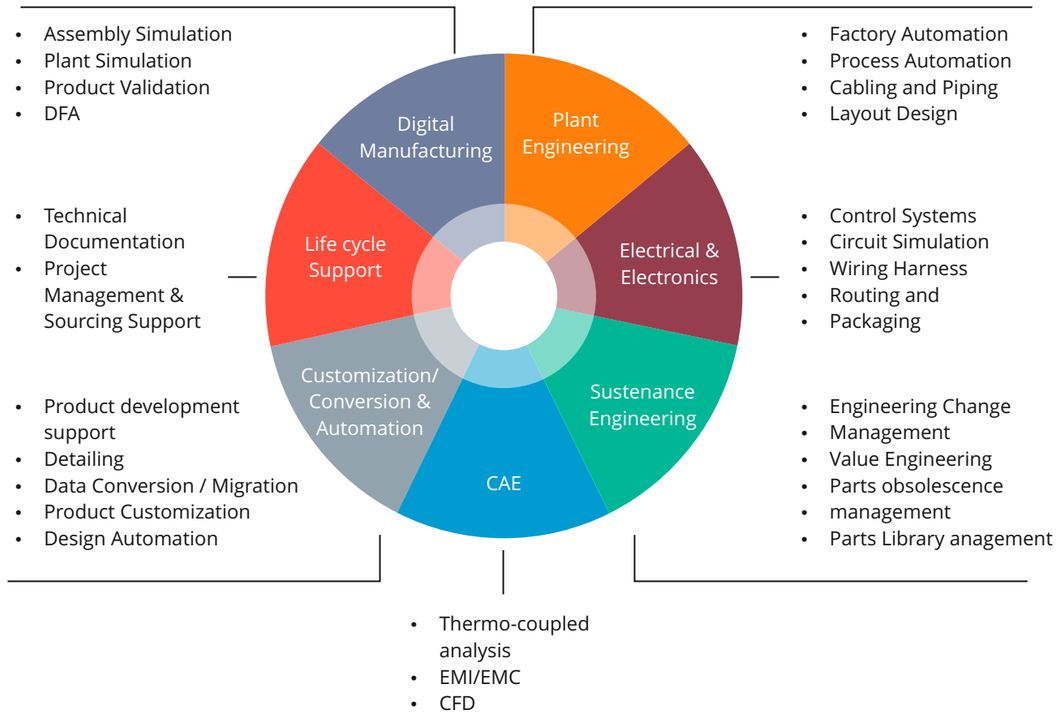
Today we live in a world of connectivity where everything, from cars to home appliances, are linked and shared with data across various platforms. With the combination of Internet of Things (henceforth called IoT) and embedded system, the users would be able to achieve much better performance compared to the current products in terms of speed and agility. This paper is an assessment of two industries, namely Hi-Tech and Automotive, and shows how mechanical engineers can get connected with mechatronics and hi-tech processes to achieve closer synergy and improved products.

In the Hi-Tech industry, products such as consumer electronics (mobiles, tablets, and washing machines), semiconductors and others related to telecom use extensive technological advances in the areas of IOT and embedded system. In the Automotive industry, various advancement such as driverless cars, 3D printing and usage of advance materials are in place to improve vehicle performance. To cater to the changing requirements of design and manufacturing, engineers working in traditional mechanical and industrial companies face an uphill task to change, adopt and upgrade to a dynamic environment and contribute to IT promoted product development in diverse ways.

The following study elaborates these aspects in greater details.

ENGINEERING AS APPLIED TO HI-TECH:

Today's Hi-tech industry faces interesting challenges in terms of lean cycles, smaller devices and smarter clients. An engineering service group can get engaged with hi-tech verticals in various ways, as illustrated in the following chart. The paper further details processes specific to the Hi-Tech industry while leaving out generic ones already included in technical publications.



1.PRODUCT VALIDATION :

Any product launched today, as governed by IOT/Embedded systems, has to balance aesthetics with functionality of the components. The examples can be illustrated in the Automotive segment using infotainment options or in the Consumer Goods segment via mobile connectivity alternatives. Product validation in such a context plays a major role in terms of validating performance parameters and forms an integral part of the overall product design cycle. The following case studies illustrate the same in details:

A: MODES OF PRODUCT VALIDATION:

Thermal-Electric simulation:

- Due to Thermal-Electric interaction, there may be coupled simulation between current flow and resistive heating. The flow of current gives rise to heat, which in turn changes the resistivity and subsequently flow of current. This type of simulation can be used in devices such as fuses, links, electrical traces, and light bulb filaments.
- Fully coupled Thermal-Electric simulation using state-of-the-art software like ABAQUS provides fully-coupled capability by including non-linear effects in material properties. This allows simulation of Joule heating phenomenon and its effects.

Simulation of PCB Electromagnetic Interference

- Simulation for meeting electromagnetic compatibility requirements related to PCB

Vibration Simulation

- Checking circuit integrity for an accelerated vibration test

Coupled Field Simulation

- Both the transient distribution of the current and temperature and the final steady state conditions determine the feasible range of operating conditions

Thermal-Mechanical Simulation

- The thermal results from Coupled Field Simulation drive a subsequent structural analysis so that thermal strains and phase changes can be studied

Today's CAE (Computer Aided Engineering) tools are capable of providing much more advanced analysis such as Coupled field, Electromagnetic and others in the Non-Linear arena. This helps the engineer to work more closely with the IoT team to support product development cycle.

B: **CASE STUDY:** ELECTRICAL-THERMAL SIMULATION: BUSBAR

Objectives

- In electrical power distribution, a busbar is a strip or bar of copper that conducts electricity within a switchboard, distribution board or other electrical apparatus. Its main purpose is to conduct a substantial current of electricity.
- Temperature-dependent electrical and thermal conductivity and Joule heat fraction (representing the fraction of electrical energy dissipated as heat) are specified.
- Appropriate boundary conditions are imposed and a fully coupled thermal-electrical transient analysis under constant electrical current flow is conducted and allowed to reach steady state conditions.

Solution:

- Both the transient distribution of the current/temperature and the final steady state conditions determine the feasible range of operating conditions for the busbar. The thermal results can also be used to drive a subsequent structural analysis of the busbar so that thermal strains and phase changes can be studied

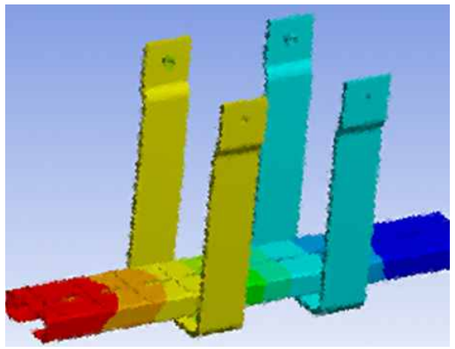


Fig: Thermal-Electric simulation Temperature Plot

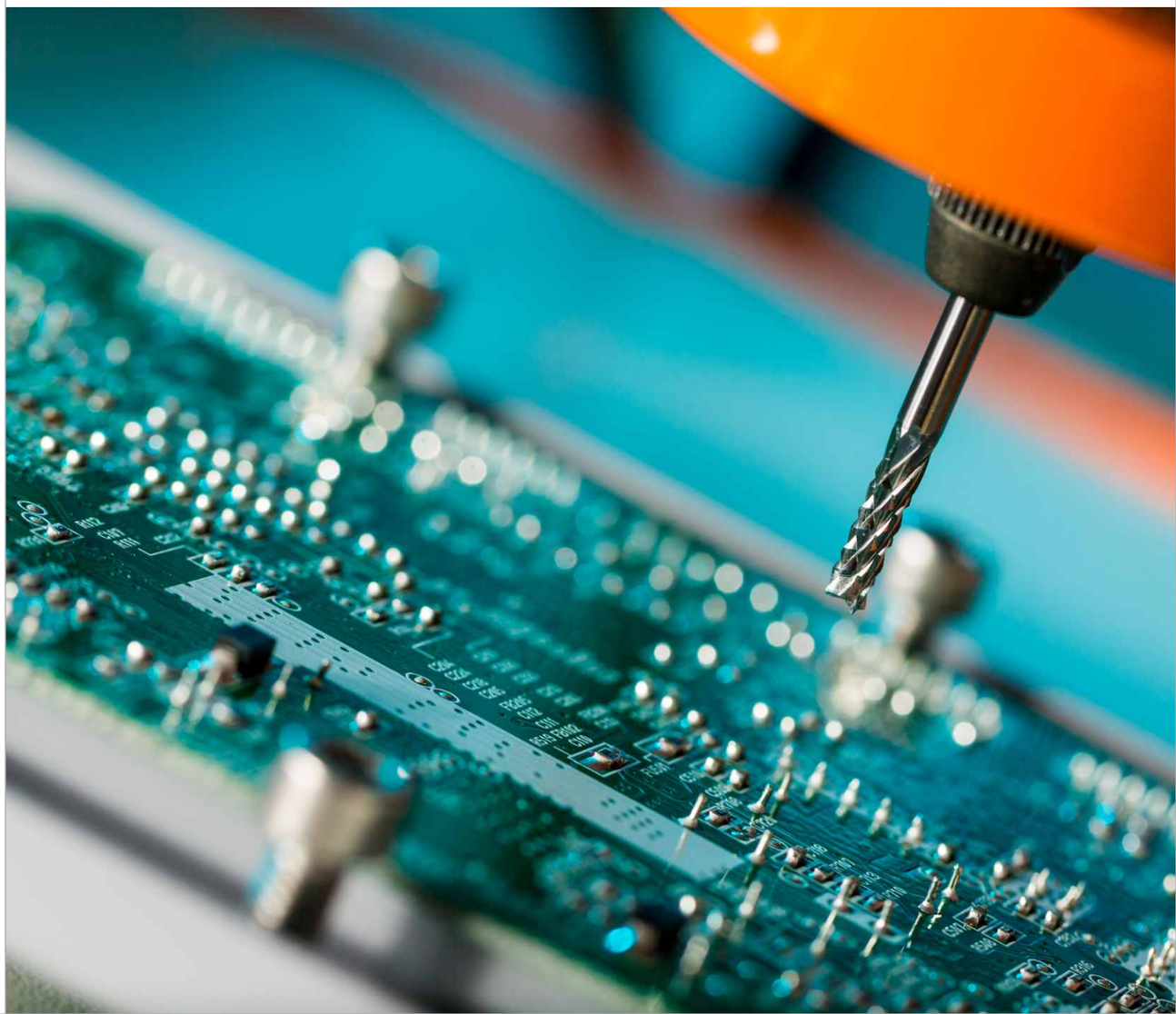
C: **CASE STUDY:** THERMAL ANALYSIS OF PCB

Thermal analysis of PCB (Printed Circuit Boards) presents a complicated flow problem where major challenges have been faced in terms of cooling solutions. As part of the solution, the user needs to take care of all modes of heat transfer. The resulting parameters such as heat flux and temperature pattern provide a much better understanding of product performance.

2. ADVANCED MATERIALS:

With the newer technologies in place, manufacturing with advanced material; typically composites in this case; plays a key role. The selection of correct material provides challenges in terms of light weighting, thermal characteristics, etc. While developing electronics component parts, material characteristics such as thermal conductivity and their interaction with support assemblies also have to be validated.

Also, today in the mobile industry, checking for Drop Test to assess performance against mechanical shock has become a common phenomenon. Ductile and brittle fractures may occur depending upon the test procedure. These studies give valuable inputs that aid in the manufacturing process design. An integrated approach that combines product design with analysis empowers the users to predict product behavior in effective ways. For example, you can model composite materials directly in various modeling software's as part of a layered approach and the same can be used for further product validation analysis.



HI-TECH ADVANCEMENTS IN AUTOMOTIVE INDUSTRY:

The Automotive industry will soon launch smarter or connected cars that are equipped with information updates on weather, traffic, alternate routes, maintenance schedules, etc. much prior to driving. These enhanced car systems require a new product development team comprising cross-functional skills and disciplines such as mechanical, electrical, electronics and software engineering.

The following scenario analysis in the areas of design/ development and manufacturing demonstrates the role of mechanical engineers in a cross-functional team

1. DESIGN AND DEVELOPMENT :

Various interesting scenarios may evolve as illustrated:

Temperature setting :

- If the electronic engineer has to develop a startup remote system which can heat up the car during the winter season, the input for the temperature range will be furnished by the mechanical designer. As the electronic engineer receives data for across different regions and monitors them, the mechanical engineer can play a vital role in analyzing the data so that the temperature range algorithm can be optimized.

Product Sensors :

- Automotive cars are fitted with various sensors that are used for different applications such as tyre pressure sensing, engine system oils pressure sensing system, power steering pressure sensor, etc. The data yielded from these sensors are current, dynamic and much more realistic and can be directly used by the design and product validation engineer to asses and improve component performance.

Electronic system and design support :

- Driver assistance systems
- Today most automotive vehicles provide for various automotive advancement systems. These includes pedestrian identification and information on foggy situations, blind spots, over-speeding, etc.
- Powertrain – Variable Valve Timing (VVT)
- Digital cockpit designs : Latest dashboards provide for scintillating digital displays combining new visual aspects along with high performance and they are also energy efficient and much more informative.
- Chassis – ABS, ASC (automatic stability control)
- Body – ECU (electronic control unit)

In all the above mentioned product variants, the automotive design engineer plays a crucial role in designing product specifications and analyzing performance and user experience.

2. MANUFACTURING

Today manufacturing has evolved from the age old Batch production method to smart factory/industry 4.0 revolutions. This simply means building ecosystem with real time information and usage of automation and digitization to provide realistic insights to the manufacturer. What's more, the scope of possibilities is not limited to manufacturing activities, but also includes supply chain management, demand management, resource pooling, etc.

Engineering support in manufacturing support activities is in fact crucial in saving cost & time. Mentioned below are some of the critical automated services / applications which aid in the manufacturing processes:

Plant Design:

Project Specifications, Product Analysis, Process Optimization, Plant Lay outing, Equipment selection, Logistics Design, Work Station Detailing, Digital Factory Modeling, Plant Simulation, Project Management

Engineering Design:

Material Handling Equipment, Automatic Transfer Systems, Welding Fixtures Design, Piping Engineering, Assembly Fixtures, Press Tool Design, SPM designs, Process Equipment

Application Development:

Customized Application Development (web/windows based), Engineering Animations, E-manuals, Manufacturing Process Data Management, CAD Customization, Document Management Systems, Customized PLM Solutions

Turnkey Solutions:

Material Handling Equipment, Automatic Transfer systems, Welding Fixtures Design, Assembly Fixtures, Press Tool Design, SPM Designs, Press Room Automation, Grippers, Tackles, Painting jigs, Inspection & Checking Fixtures, Imaging Solutions, Press Tools, Piercing SPMs, Manipulators, Turn-Over devices, Conveyors

AT ITC INFOTECH:

Integrated Design Engineering Services (IDES) & the need for it:

Our customer's products are becoming increasingly complex with the addition of electronic and electrical sub-systems for enhancing product capabilities and performance. Their products should also satisfy shifting end-user needs and regulatory requirements, drive product and process innovation, and anticipate the impact of potentially disruptive technologies on their business and operating models.

Besides, we need to leverage and maximize the synergies/capabilities existing in different groups of engineering services, embedded systems, PLM, SLM and IoT and also cross-sell different services within the existing customer eco-system. Given all of these, the various groups are being brought under one umbrella called Integrated Engineering Services. The objective is to provide differentiated value as a 'One Stop Design Engineering Services' partner to our customers. With this clearly defined approach, we at ITC InfoTech expect to cater to a broader customer base more efficiently and effectively.

CONCLUSION:

This paper takes a bird's eye view on interaction between the Hi-Tech Industry and mechanical engineers and elaborates the resulting possibilities with regard to two industries, namely Hi-tech and Automotive. The same look-out can be extended to other industries such as Aerospace, Heavy Engineering and Industrial Machinery.

Extending the scope of Mechanical Engineering beyond traditional systems and providing engineering support to new and upcoming segments like the Hi-Tech industry will not only provide opportunity for enhanced product development and competitive products, but also enable mechanical engineers to explore new techniques to improve traditional mechanical systems.

AUTHOR PROFILES

Swanand Jawadekar is having more than twenty years of experience in the areas of Computer Aided Engineering along with project execution, training, deep dive technical studies and offshore consulting. He has worked with international customers such as Ford, JLR on long term projects which involved customer facing roles, developing solutions. He has also engaged in the role of Key account manager and Business transformation catalyst with major global customers, enabling value creation for customers by providing solutions and services with a focus on the Automotive, Aerospace, and Industrial Machinery.

Prasad Balgaonkar is Mechanical engineer with over 12 years' experience in areas of CAE analysis for Full vehicle, BIW & system level validation plans. Working experience on Crash Simulations, NV & Durability analysis. Engaged on various automotive vehicle programs such as Seating System, Instrument Panel, BIW development, Front Fascia exterior development etc. Key Competencies and working experience in CAE driven design validation & optimization, Test-FE correlation, Crash Simulations. Worked with Domestic and International customers like Tata Motors, Chrysler and European OEMs.

About ITC Infotech

ITC Infotech is a specialized global scale - full service provider of Domain, Data and Digital technology solutions, backed by a strong business and technology consulting focus. The company caters to enterprises in Supply Chain based industries (CPG, Retail, Manufacturing, Hi-Tech) and Services (Banking, Financial Services and Insurance, Airline, Hospitality) through a combination of traditional and newer business models, as a long term sustainable partner.

ITC Infotech is a fully owned subsidiary of USD 8bn ITC Ltd – one of India's most admired companies.

www.itcinfotech.com | contact.us@itcinfotech.com

©2016 ITC Infotech. All rights reserved.