Successful contact pressure validation for 'O' ring with contact analysis

Imperial Auto, an integrated Fluid Transmission Products manufacturer, was facing a critical challenge to optimise fluid flow and minimise the fluid loss. For a set of challenges faced in a particular project to fix an 'O' ring leakage, the company reached to Altair for its simulation products, like HyperWorks, HyperMesh, etc. The case study explains how Altair helped Imperial Auto cut down on the number of prototype iterations and reduce the turnaround time.

Established in the year 1969, Imperial Auto is one of the world's biggest integrated manufacturers of 'Fluid Transmission Products (FTPs). The company has eight dedicated manufacturing and assembly plants in India. Imperial's multi-location, state-of-the-art manufacturing facilities have diversified product portfolio and it serves the niche clientele. The grand vision of the company's top management can be easily gauged from the strategic and technical alliances that it has formed with major international players in their industry. The company operates on a global scale and has a strong worldwide presence in their market. Imperial is a major and important supplier of parts to leading engine, automotive, off-highway and farm equipment OEMs worldwide and also boasts of multiple overseas warehousing facilities to serve its clients seamlessly.

The company believes in manufacturing only world-class quality products and considers its high level of commitment towards continuous improvement as the most important prerequisite of serving clients on a global scale. It has made significant investment in its R&D initiatives. It has a robust headcount of 3000 employees and has some of the most coveted and respected quality & environmental certifications, such as the ISO / TS 16949:2009 and ISO 14001:2004. Some of the global OEMs, such as Caterpillar, Cummins, FIAT Powertrain, Navistar, General Motors, JCB and John Deere, find a place in the company's client list.

Reducing prototype iterations & turnaround time

Being an important supplier to some of the world's most

reputed OEMs, the company considers it imperative on its part to be very innovative in the product design and development processes. It becomes more important for them in the automotive industry vertical because they manufacture fluid transmission pipes, which are crucial for a controlled and sustained flow of fluids (petrol, diesel, brake oil and coolant). In this critical and highly dynamic environment, the company found it challenging to optimise fluid flow and minimise fluid loss. The Imperial team also understood the importance of having a secured, predictable and confirmed process that will generate accurate results in its innovation efforts. To add to this, because the team comprehended even the finer nuances of their processes, they wanted their R&D solutions to be robust enough to handle all platform variations and be scalability compliant. Through this, the team wanted to ensure that the complete design of a product is handled in one common environment.

Amidst this backdrop, the Imperial team faced a set of challenges in one of their important projects. In their pursuit of designing and building a flawless assembly component, the team had to check the 'O' ring leakage that could withstand required air pressure of 3 kg/cm^2. In this endeavour, the team struggled with an iterative process because they had to build several prototypes to confirm the 'O' ring leakage. This trial-and-error method to check the 'O' ring leakage and build a flawless product was unreliable and took a considerable amount of time to finalise the product design.

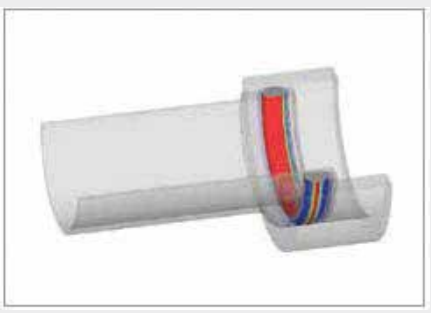
Analyse & interpret results using HyperWorks

When faced with this challenge, the team wanted a solution that could help them cut the turnaround time, reduce prototype iterations and also improve the design & product quality. After examining a few simulation products which met the requirements, the Imperial team finalised Altair's HyperWorks, as its features were an exact fit that promised to deliver. The team started with utilising the meshing capabilities of Altair HyperMesh™ to mesh the model. It had a ready rubber model that had the required material properties. Simulation in HyperWorks made it easy

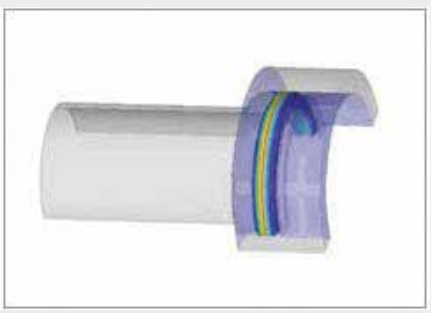
O-Ring Application

Displacement

Contact Traction / Normal (pressure)



Contact Status / Normal



Contact Forces / Normal

O-Ring

for the team to establish contact between the 'O' ring, pipe and the cylinder bore. The team then analysed the result by using the non-linear Quasi Static analysis method and effortlessly simulated the product's physical behaviour. In the final stage, the team used Altair HyperView™ to interpret the analysis results objectively when it came to contact requirements. "Implementing Altair Solutions in our R&D division has brought considerable change. The token-based licensing model is easy to adopt and execute as it offers complete flexibility to users," mentioned Kushal Bir, Vice-President, Imperial Auto Industries.

Reduced turnaround time with time & cost savings

The Imperial team found an excellent and dependable solution in HyperWorks. The team was ecstatic that it enabled them to interpret the results with regards to contacts for various parameters and scenarios, such as contact status, contact forces and contact pressure. HyperWorks made it possible for the Imperial team to confirm the requirement of the 'O' ring to prevent leakages. The team also interpreted that the required air pressure was within the allowable specifications. With the team delivering excellent results with the HyperWorks suite on similar projects, they are excited to explore more capabilities of the solution. With its deployment, the company saved an incredible 70% of the overall product development time. This translated in a significant reduction in the number of prototypes that were earlier built to reach the target quality of the product. With time and prototype iterations taking the downward curve, the team achieved an impressive saving of almost 40-50% of the product development cost too. This has gained customer confidence and resulted in customer satisfaction.

Propelled by the project result, the team implemented Altair OptiStruct™ for design optimisation activities and managed to reduce design weight easily. The team is happy that the Altair HyperWorks suite acts as a one-stop-shop for its requirements and reduces their prototype count, shortens the iterative process, and hence, reduces the final turnaround time. "Altair HyperWorks™ helped us cut down on the number of prototype iterations, final turnaround time and also saved on the project cost. We are now keen on exploring other capabilities of the Altair CAE Suite in our product development cycle. Also, both DesignTech and Altair Technical teams provided excellent support and training. With their help, we were able to realise newer applications of tools that we could use in our product line," Nikhil Srivastava, Sr CAE Engineer (R&D Department), Imperial Auto Industries, signed off. □

Courtesy: DesignTech Systems