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TATA MOTORS uses PAM-STAMP 2G to shape a 3-ply steel/polymer sandwich oil sump to reduce noise

PROCESS

Stamping of " Silent steel ", a steel/polymer sandwich material, requires specific care.

THE STORY

A Noise-Vibration-Harshness (NVH) study from Tata Motors shows that maximum engine noise comes from the oil sump. The objective is to reduce the noise from the oil sump.

Apart from changing the design of the part, they also looked at changing the material to a 3 ply " silent steel " for the design of new oil sumps. Tata Motors sought to synergize part geometry with the new intended material. Simulation allowed them to experiment, validate, and ultimately completely redefine and optimize their original concept.

THE BENEFITS

- Early resolution of various manufacturing and vehicle-level constraints.
- Developed such a confidence in virtual simulation that digital validation sufficed to release physical manufacturing.

"With simulation solutions such as PAM-STAMP 2G, simple and easy-to-manufacture part design proves very cost-effective and without compromise in terms of quality. The constructive and positive team effort leads to unique cost-effective solutions that could have been discarded as unfeasible without the synergized effort of tool and product designers."

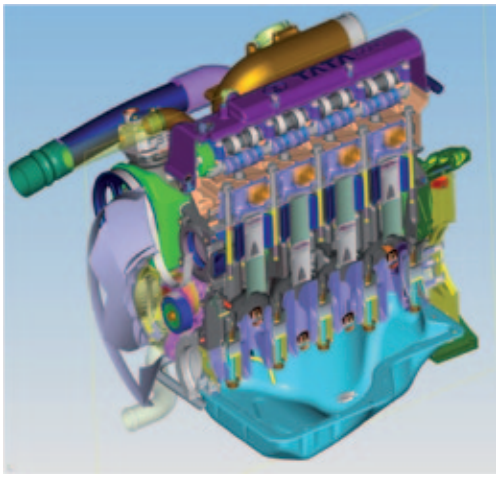
Brian D' Cruz
Program Manager, Tata Technologies

SILENT STEEL

The objective of this project was to implement " silent steel " in the new engine oil sumps for upcoming vehicle platforms.

Silent steel is a three-ply sandwich material in which two sheets of steel are held together by a layer of polymer. The resulting material displays inherent advantages in the Noise-Vibration-Harshness (NVH) characteristics, particularly significant in the immediate vicinity of the vehicle engine.

Due to the layered nature of silent steel, its shaping requires careful design and construction of the stamping tools.



Oil Sump in its vehicle environment

COMPLEX DESIGN DUE TO MULTIPLE CONSTRAINTS

The initial sump design, as conceived by the Product Designer, needed to be prototyped for validation. Although the techniques used for prototyping, including heating and hammering blank sheets, provided fairly accurate product geometry, they were not quite representative of the stamping process which would be implemented later on. Feasibility could not be assessed and tooling limitations could not be anticipated with the three-play silent material. Due to the progress of vehicle development, additional constraints from interfaces and assembly accumulated.

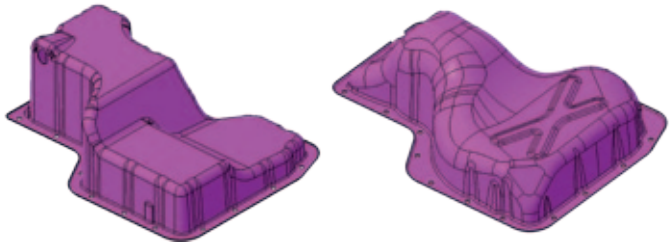
PRODUCTIVITY BOOST WITH PAM-STAMP 2G

As constraints from the vehicle environment, from the tooling, and from the material itself were building up, over 25 different geometry modifications were needed before reaching a satisfactory final design that was good enough to be tried out physically with silent material. PAM-STAMP 2G was used to validate each design evolution until a defect-free feasible solution was reached.

TACKLING MULTI-PARAMETER CONSTRAINTS

The iterative process framing the part's modifications had to take into account the following constraints:

Vehicle Assembly	Hard Tooling Manufacturing
. Tooled-up bed plate interfaces	. Higher depth vs. Corner radius
. Oil capacity limitations	. Side wall caving (quality issue)
. Critical assembly clearances	. Drain mounting geometry
. Mounting flatness	. Sharp profiles at the top corners
. Maximum thinning limitations	. Sudden sectional variations

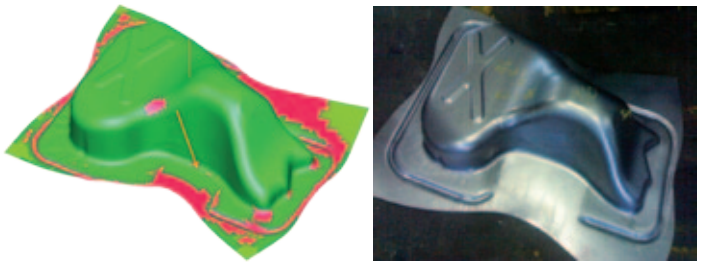


Initial (left) and final (right) design after 25 iterations

The above images reveal the extent of the modifications required to take into account manufacturing needs with minimal compromises in assembly for the silent material.

IMMEDIATE APPLICABILITY

Surely enough, the first physical prototypes in the stamping tool workshop matched very closely the modeled result.



PAM-STAMP 2G virtual prototype and 1st physical prototype

Seemingly diverging manufacturing and vehicle-level constraints were resolved with simulation. Tata Motors 8 CPU DMP license resulted in a marked reduction in prototyping time and heavy gains in time-to-market. These achievements kindled a very high faith in virtual prototyping abilities, leading to more daring designs much earlier in the product development phase.

ABOUT TATA MOTORS

Tata Motors is India's largest automobile company, with consolidated revenues of Rs.70,938.85 crores ($ 14 billion) in 2008-09. Through subsidiaries and associate companies, Tata Motors has operations in the UK, South Korea, Thailand and Spain. Among them is Jaguar Land Rover, the business comprising the two iconic British brands. It also has an industrial joint venture with Fiat in India. With over 4 million Tata vehicles plying in India, Tata Motors is the country's market leader in commercial vehicles and among the top three in passenger vehicles. It is also the world's fourth largest truck manufacturer and the second largest bus manufacturer. Tata cars, buses and trucks are being marketed in several countries in Europe, Africa, the Middle East, South Asia, South East Asia and South America. (www.tatamotors.com)

ABOUT ESI GROUP

ESI is a pioneer and world-leading provider in virtual prototyping that takes into account the physics of materials. ESI has developed an extensive suite of coherent, industry-oriented applications to realistically simulate a product's behavior during testing, to fine-tune manufacturing processes in accordance with desired product performance, and to evaluate the environment's impact on performance. ESI's solutions fit into a single collaborative and open environment for End-to-End Virtual Prototyping, thus eliminating the need for physical prototypes during product development. The company employs over 750 high-level specialists worldwide covering more than 30 countries. ESI Group is listed in compartment C of NYSE Euronext Paris. For further information, visit www.esi-group.com.

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