JSOL CORPORATION

![Xstream ENGINEERING — MSC Software Company logo]

# Engine Backfire in an Air Intake Manifold

PARTNER: JSOL Corporation

- Committed to delivering comprehensive CAE solutions and strategic consulting focusing on digital engineering
- Largest LS-DYNA reseller in Japan
- Well known for adopting and using cutting edge technologies

CHALLENGE

- To comply to the environmental needs of automotive industry and deliver greener technology by weight saving
- To support the process of design of under-the hood plastic parts reinforced with glass fibers

HOW TO MODEL THE CRITICAL INFLUENCE OF FIBER ORIENTATIONS FOR UNDER-THE-HOOD PLASTIC PARTS?

Pressure from engine backfire

$t_1 = 8$ ms $t_2 = 12$ ms
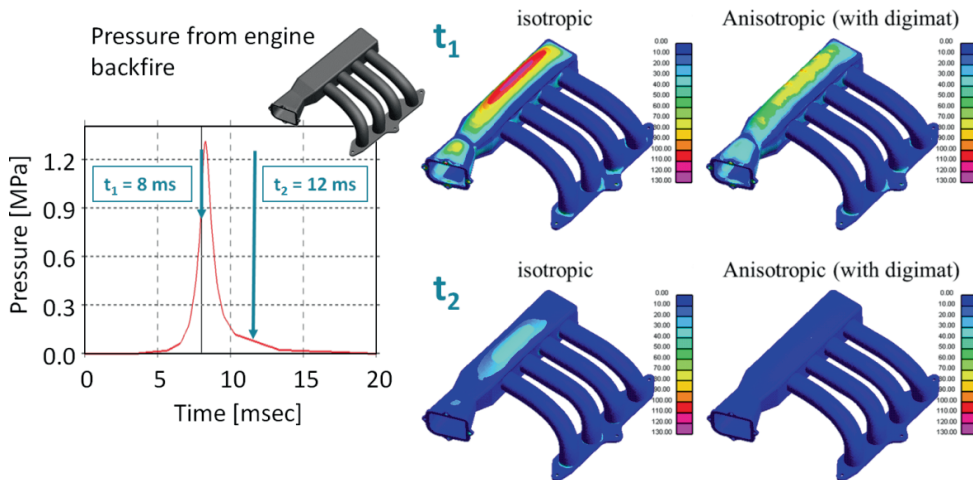
DIGIMAT SOLUTION

- Calibration of an elasto-plastic DIGIMAT material
- Simulation of the load case with Digimat-CAE/LS-DYNA interface based on fiber orientations coming from injection molding
- Comparison of maximum principle stresses of the composite material with an isotropic calculation

RESULTS

- For the high pressure peak ($t_1 = 8$ ms) and the low pressure region ($t_1 = 12$ ms) significant differences in the stress distribution are observed compared to the simulation using isotropic material
- The fiber reinforced part shows lower stresses than the isotropic case pointing out an over-designed part
- Potentially further weight can be saved on the part by introducing DIGIMAT in the design cycle

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MATERIALS
Reinforced plastics

PERFORMANCES
Impact

DIGIMAT
Digimat-MF, Digimat-CAE, Digimat-MAP, Digimat-MX

CAE TECHNOLOGY
LS-DYNA, Moldex3D

INDUSTRY
Automotive

APPLICATION
Air intake manifold

"Fiber reinforced plastic becomes major material for intake manifold because of lightweight and heat resisting properties. Detecting the correct high stress concentration area is important to predict fatigue properties of manifold. DIGIMAT helps us to predict correct stress distribution by taking into account the fiber orientation coming from injection molding. "

Noriyo Ichinose, Sales engineer, JSOL Corporation, Japan

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www.e-Xstream.com

Digimat

The nonlinear multi-scale material & structure modeling platform

Digimat material modeling platform means developing innovative, optimized and cost-effective products. As a unique nonlinear multi-scale material and structure modeling platform, Digimat offers:

Digimat MF: Mean-Field homogenization software used to predict the nonlinear behavior of multi-phase materials.

Digimat FE: Finite Element based homogenization software used to model the nonlinear behavior of Representative Volume Elements (RVE) of material microstructures.

Digimat MX: Material eXchange platform used to prepare, store, retrieve and securely exchange Digimat material models between material suppliers and end-users**.**

Digimat CAE: Digimat linear and nonlinear interfaces to major processing and structural FEA software to enable multi-scale analyses of composite structures.

Digimat MAP: Shell & 3D mapping software used to transfer fiber orientation, residual stresses and temperatures between dissimilar processing and structural meshes.

Digimat RP: Easy and efficient solution for the design of fiber reinforced plastic parts.

Digimat HC: Easy and efficient solution for the design of honeycomb sandwich panels.

e-Xstream ENGINEERING
MSC Software Company

The material modeling company

e-Xstream engineering is a provider of simulation software & engineering services, 100% focused on advanced material modeling. e-Xstream was founded in 2003 in Belgium and Luxembourg. e-Xstream is an MSC Software company since September 2012 with more than 1100 associates working from over 20 offices around the world.

e-Xstream engineering develops and commercializes Digimat – the nonlinear multi-scale material and structure modeling platform that fastens the development of optimal composite materials and parts.

Digimat customers are material experts and structural engineers who accurately predict the behavior of multi-phase composite materials and structures. Digimat is used by all major material suppliers and users across all industries (Automotive, Aerospace, Electric & Electronics, Leisure, Defense ...).

With this important customer base worldwide, e-Xstream combines deep expertise in material modeling and numerical simulations with the business understanding of the large variety of materials used across all industries.

www.e-Xstream.com

MF

FE

MX

CAE

MAP

RP

HC