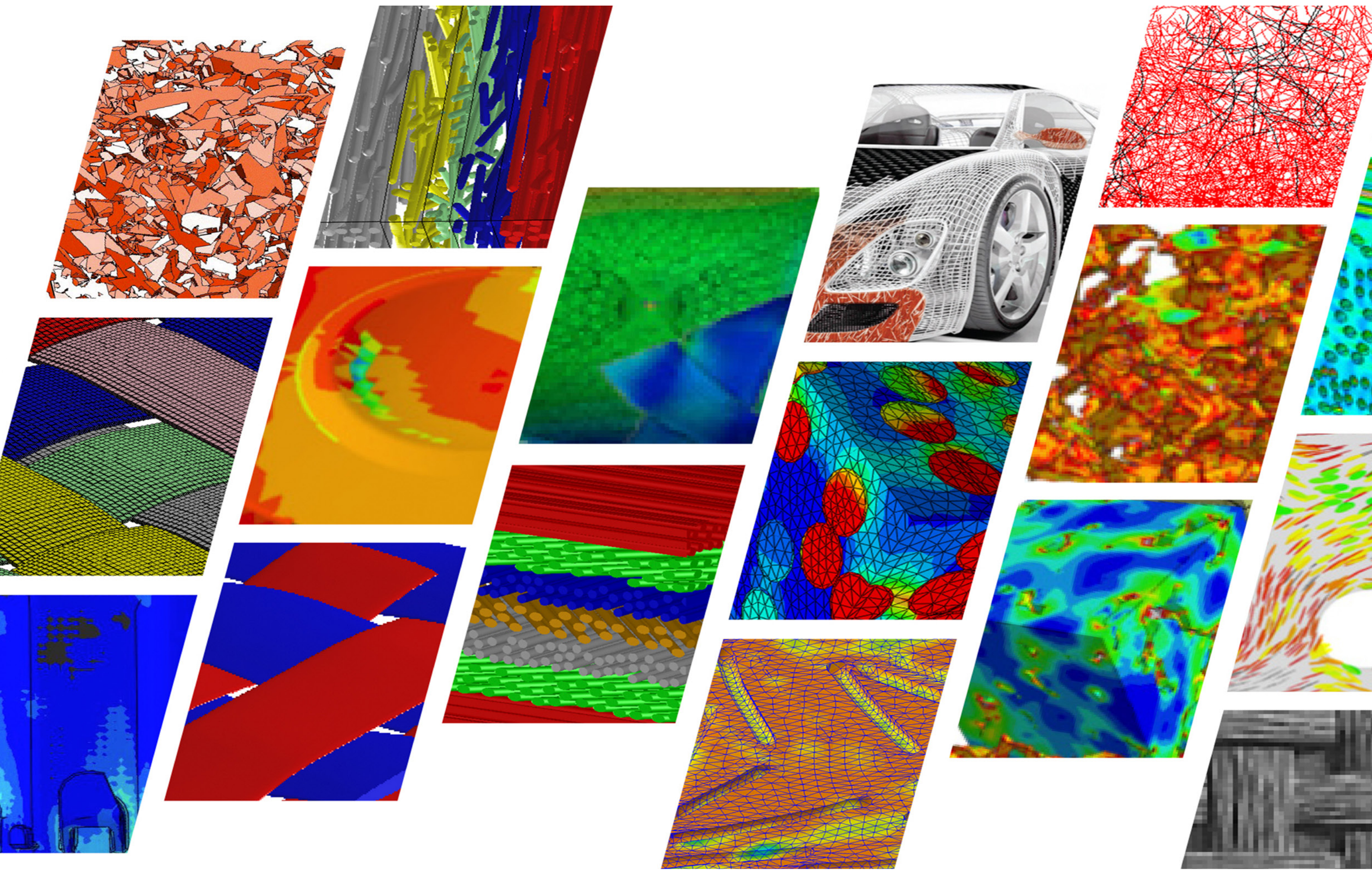
Digimat

The material modeling platform



Digimat

e-Xstream engineering develops and commercializes Digimat, a state-of-the-art multi-scale material modeling technology that helps speed up the development process for plastic & composite materials and structures.

Digimat is used by CAE engineers, specialists in manufacturing proceeses of composite materials and materials scientists to accurately predict the nonlinear micromechanical behavior of complex multi-phase composite materials and structures.

Digimat, winner of the JEC Innovation of the Year Award 2014, is relied upon by major Material Suppliers, Tier1s and OEMS worldwide in various industries. It bridges the gap between manufacturing and structural performance. It helps multi-industries using plastics & composites.

The usage of Digimat follows two major strategies:

Material Engineering

The purpose of material engineering is to take a simulation approach for the identification of promising candidates for new composite materials thereby reducing the amount of experiments needed. This helps to save money and to reduce the time needed to develop new materials.

In research the approach allows to gain insight into and to understand mechanisms that dominate the macroscopic material properties but actually arise from its microscopic composition.

Structural Engineering

The purpose of structural engineering is to design full composite parts. The focus is on the part performance as it depends on the material characteristics and the manufacturing method and conditions that were used for the individual design.

Key to this challenge is a material model that correlates to experimental behavior as closely as possible. For this purpose a reverse engineering procedure is used that results in the parametrization of micro-mechanical models and their adaption to a set of anisotropic material measurements to meet the global composite performance best possible.

Such material models can now read locally different micro-structure information from various sources and convert them into a local material property. A fully coupled analysis results in a simulation model with individual material properties described for each integration point in the Finite Element analysis. Coupled analyses are state-of-the art for the modeling of composite parts and have proven to match experimental observation perfectly on many occasions.

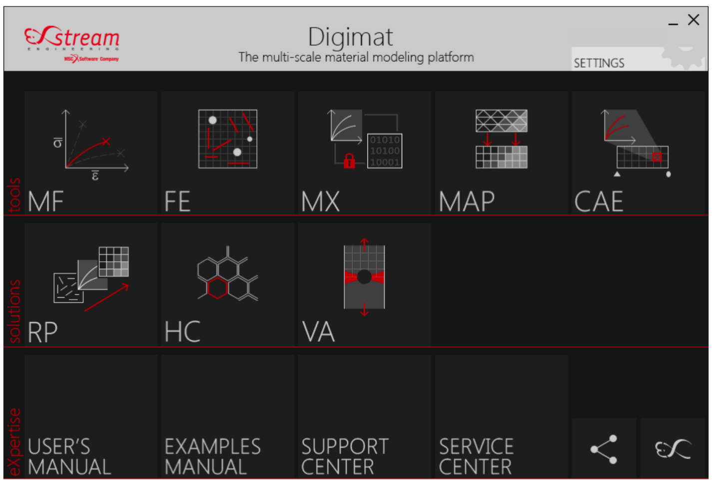
The material modeling platform

Digimat offers 3 different categories of products:

• Tools
A complete set of complementary interoperable software products focused on expert usage for material and/or structural engineering.

• Solutions
Easy, process-centric and user-friendly usage of Digimat technology from fully integrated GUI guided environments for specific tasks (e.g. running coupled analyses for short fiber reinforced plastic parts with Digimat-RP).

• eXpertise
Knowledge transfer from 11+ years of experience in micromechanical modeling. It includes a Digimat Users' Manual, as well as access to e-Xstream offers for services, support and trainings. Digimat, furthermore, offers online social platforms to share insights and get updated on recent activities and news.



Digimat platform. Tools, solutions and eXpertise

Digimat-MF

Digimat-MF is a mean-field homogenization tool used to rapidly compute the macroscopic performance of composite materials from their per-phase properties and microstructure definition.

Digimat-MF aims at realistically predicting the nonlinear constitutive behavior of multi-phase materials taking into account temperature and strain rate dependencies. The composite morphology such as filler content, length, aspect ratio and orientation take full impact on the resulting composite behavior.

The technology is especially well suited to describe fiber reinforced composites:

- Short fiber reinforced plastics
- Long fiber thermoplastics
- Unidirectional composites
- Woven composites

A broad range of performances can realistically be predicted:

- Stiffness
- Failure
- Creep
- Fatigue
- Conductivity (thermal & electrical)

New Capabilities

- Failure indicators
  - Temperature dependent strengths in failure criteria
- Similar capabilities to strain rate dependencie
- Thermo-elastic and thermo-elastoplastic models
- Progressive failure
  - New multicomponent 2D failure indicator
  - Combination of multiple damage laws in a single failure indicator
    - Accurate damage description with improved CPU efficiency
- Drucker-Prager
  - New formulation of isotropization for enhanced robustness
- Curing
  - Johnstonn-Hubert model for UD materials
  - Access to curing state allowing to define specific dependences of material parameters for thermo-elastic and thermo-viscoelastic models
  - No chemical shrinkage
  - Constant CTE definition above and below glass transition temperature
- Outputs
  - New options allowing to select the number of digit in the output files

Main Capabilities

Nonlinear (per-phase) Material Models

- Linear (Thermo) Elasticity: Isotropic / Transversely isotropic / Orthotropic / Anisotropic
- Linear Viscoelasticity
- (Thermo) Elastoplasticity:
  J2 Plasticity and Isotropic hardening
  - Power / Exponential / Exponential linear laws: Kinematic hardening (linear with restoration)
- For cyclic elastoplasticity: Drucker-Prager
- Elastoplasticity with Damage:
  Lemaître-Chaboche
- (Thermo) Elasto-Viscoplasticity:
  - Norton / Power / Prandtl laws / Time law
- Viscoelasticity-Viscoplasticity
- Hyperelasticity (finite strain):
  - Neo-Hookean / Mooney-Rivlin / Ogden / Swanson / Storakers (compressible foams)
- Elasto-viscoplasticity (finite strain):
  Leonov-EGP
- Thermal & electrical conductivity: Ohm & Fourier

Microstructure Morphology

- Multiple reinforcement phases
- Multi-layer microstructure
- Ellipsoidal reinforcements (fillers, fibers, platelets)
- Aspect ratio distribution
- General orientation
  (fixed, random, 2nd order orientation tensor)
- Void inclusions
- Coated inclusions with relative or absolute thickness
- Deformable, quasi-rigid or rigid inclusions
- Clustering

Homogenization Methods

- Mori-Tanaka
- Interpolative double inclusion
- 1st and 2nd order homogenization schemes
- Multi-step, multi-level homogenization methods

Failure Indicators

- Applied at micro and/or macro scale, or on pseudo-grains using the FPGF model (First Pseudo-Grain Failure model)
- Failure models: Maximum stress and strain, Tsai-Hill 2D, 3D & 3D Transversely Iostropic, Azzi- Tsai-Hill 2D, Tsai-Wu 2D, 3D & 3D Transversely Isotropic, Hashin-Rotem 2D, Hashin 2D & 3D, SIFT, User-defined
- Strain rate dependent failure criteria
- Failure criteria on Leonov-EGP & hyperelastic material models

Progressive Failure

- Failure: Hashin 2D / Hashin 3D / Hashin-Rotem 2D
- Damage: Matzenmiller / Lubliner / Taylor (MLT) / Individual damage evolution functions
- Stabilization control using viscous regularization

Fatigue

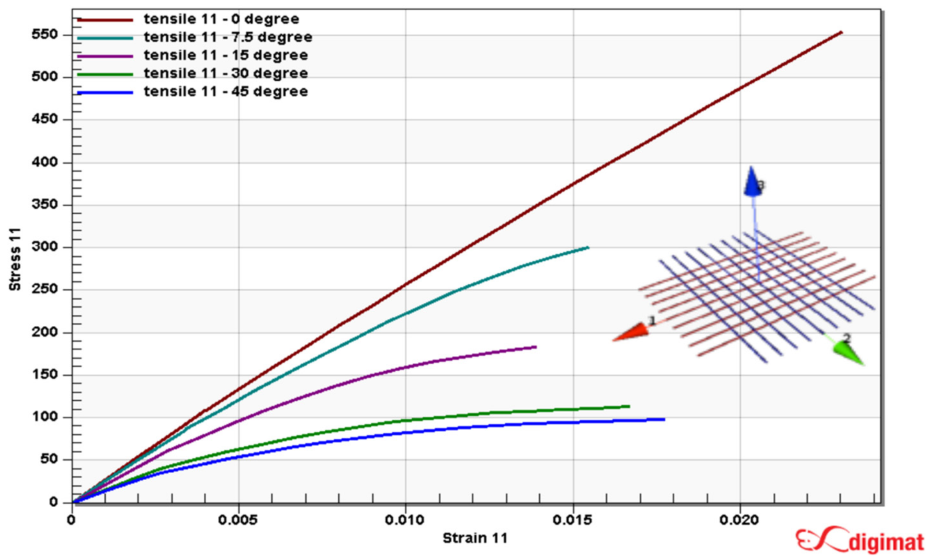
- Pseudo-grain based fatigue model specifically for short fiber reinforced plastics
- Matrix damage based fatigue model for unidirectional composites

Loading

- Monotonic, cyclic or user-defined history loading
- Multi-axial stress or strain, General 2D & 3D
- Mechanical and thermo-mechanical
- Prediction of thermal & electrical conductivities
- Loading definition from structural FEA results

Further functionalities:

- Prediction of orthotropic engineering constants
- User defined outputs
- Interoperability with Digimat-FE and Digimat-MX
- Handling of encrypted material files



Stiffness & failure of thermoplastics based woven composites dependent of the fiber orientation

FE

Digimat-FE

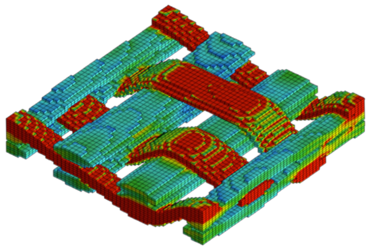
Digimat-FE is the tool used at a microscopic level in order to gain an in-depth view into the composite material by the direct investigation of Representative Volume Elements (RVEs). Digimat-FE acts as a stochastic generator of highly realistic RVEs covering a large variety of materials: plastics, rubbers, metals, ceramics, nano-filled materials.

Based on material input and the microstructure definition, a finite element model is built and submitted to analysis. The results of the FE analysis are post-processed by using probabilistic distribution functions that give detailed insight into the RVE. Mean homogenized values are computed and can be used in subsequent FE analysis on the structural part level.

End-to-end solution

A complete end-to-end solution has been implemented in Digimat. It allows performing all the different steps needed to obtain a complete FE analysis - starting from the material data. For instance, the steps followed to model woven composites are:

- Extraction of the material data from the datasheet
- Mean-field homogenization of the yarns
- Generation of a geometry of a unit cell
- Generation of a RVE
- Voxelisation
- FE model definition and application of periodic boundary conditions
- Solving the FE analysis
- Post-processing the outputs of the FE analysis



Voxel based solution for a woven 2.5D composite material computed in Digimat-FE

New Capabilities

- Discontinuous long fiber composites
  - Specific RVE generation algorithm allowing to generate DLF microstructures
- Automatic stiffness generation
  - New options allowing to automatically compute orthotropic engineering moduli (stiffness & conductivities)
- Curing
  - Available with FE solver
  - Johnston-Hubert model
  - Computation of chemical shrinkage
  - Constant CTE definition above and below glass transition temperature
  - Access to curing state allowing to define specific dependences of material parameters for thermo-elastic and thermo-viscoelastic models
- Additional material models
  - Thermo-viscoelastic in Marc and FE solver
  - Drucker-Prager in Abaqus
- CPU improvements when post-processing Marc and FE solver results files
- Interface to J-Octa
  - User definition of inclusions' positions and orientations
- Licensing
  - Mesh generation and visualization now accessible with DIGIMAT_FE_MODELER

Main Capabilities

- Definition of composite constituents
- Inclusion shapes (Spheroid, Platelet, Ellipsoid, Cylinder, User defined, etc.)
- Material models (Elastic, (Thermo) Elastic, (Thermo) Elastoplastic, Viscoelastic, etc.)
- Inter-operability with Digimat-MF and Digimat-MX for material definition

Microstructure Definition

- Microstructure morphology definition: Volume / Mass fraction
- Multiple inclusion shapes
- General orientation definition (fixed, random, 2nd order orientation tensor)
- Fiber length with access to size distribution
- Coating
- Inclusion / Matrix debonding
- Multi-layer microstructure

RVE Generation

- RVE microstructure generation with real-time preview & animation process
- Maximum packing algorithm
- 3D & 2D RVEs

FE Meshing

- Automatic adaptative mesh seeding and iterative mesh generation in Abaqus/CAE and ANSYS Workbench
- RVE meshing embedded beam elements, straight or curved

RVE Analysis

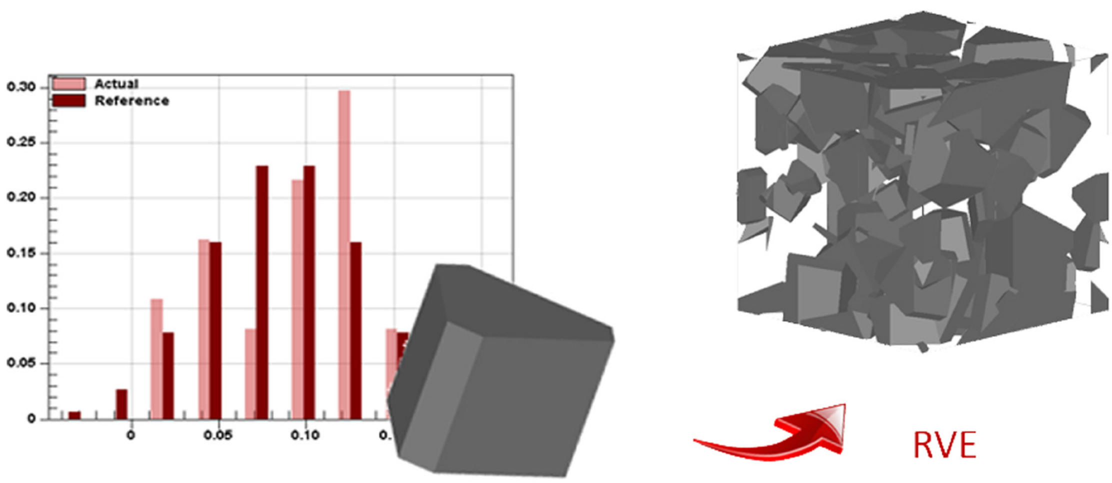
- Monotonic / Cyclic / User-defined history loadings
- Multi-axial stress or strain, General 2D & 3D
- Mechanical and thermo-mechanical
- Computation of the percolation threshold
- Prediction of thermal and electrical conductivities
- Loading definition from structural FEA, i.e. Abaqus ODB file
- Export of RVE geometry in common formats: STEP, IGES, BREP
- Export geometry and model definition to Marc, Abaqus/CAE and ANSYS Workbench

Embedded solver

- Digimat-FE solver for end-to-end solution
- FE analysis can be started & monitored from within Digimat-FE

Post-Processing

- Field visualization of results over RVE
- Computation & visualization of resultant distributions over RVE
- Computation of representative (mean) properties



Generation of complex RVE based on geometric shape & size distribution

Digimat-MX

Digimat-MX is an eXchange tool that allows the user to reverse engineer, store, retrieve and securely share micromechanical models between material experts and designers of composite parts.

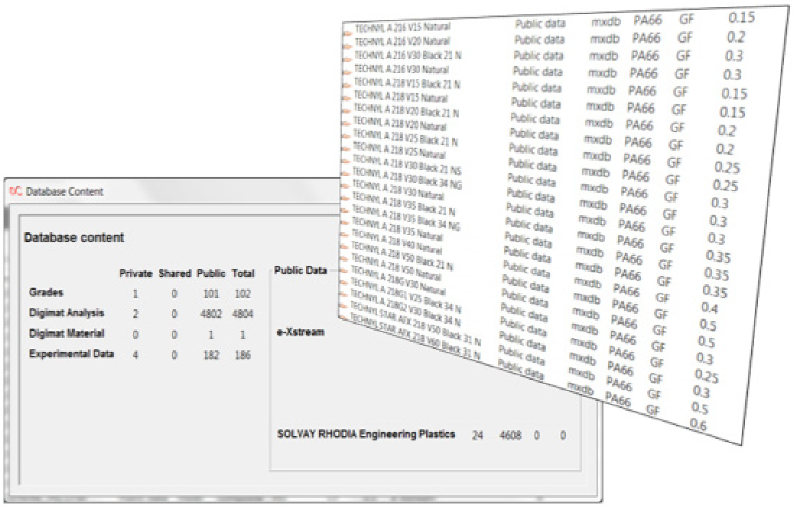
Digimat-MX tool stores anisotropic measurements and related micromechanical models. Embedded parameterization tools allow you to adapt the material performance to experimental data. Resulting Digimat models can be shared within large communities of different users.

Intellectual property is assured by built-in encryption technology.

Digimat-MX comes along with:

Public Data:
- Ready-to-run Digimat material models
- Experimental data as a base for building Digimat material models

Database setup & tools:
- Flexible user/group scenarios
- Data import & reverse engineering of Digimat material models
- Encryption technology for secured sharing



Public data for Short fiber reinforced plastics and UD & woven composites

New capabilities

- Reverse engineering of Tsai-Wu 3D transversely isotropic failure criterion
- Improved algorithm for reverse engineering
  - Local method
  - Global method

Main capabilities

Material database

- Public data:
  - From several suppliers: Solvay, Sabic, Dupont, Ticona, Evonik, LyonDellBasell, EMS, Lanxess
  - From e-Xstream: generic grade (chopped fiber and continuous fiber)
- Gives access to:
  - Experimental data (tensile)
  - Digimat material / analysis files for homogeneous / composite materials: chopped fibers (short, long), continuous fibers(woven, unidirectional)
- Data available under various conditions:
  - Temperature, relative humidity, strain rates & loading angles

Parametric identification

- Identify material model parameters based on the homogeneous material responses
  - Can be done on one or several curves at the same time

Encryption

- Material files can be encrypted for confidentiality purposes (available in MX+)
- Encrypted files can be used in Digimat-MF and Digimat-CAE, the material parameters being hidden
- Encrypted material files can be attributed an expiration date (available in MX+)

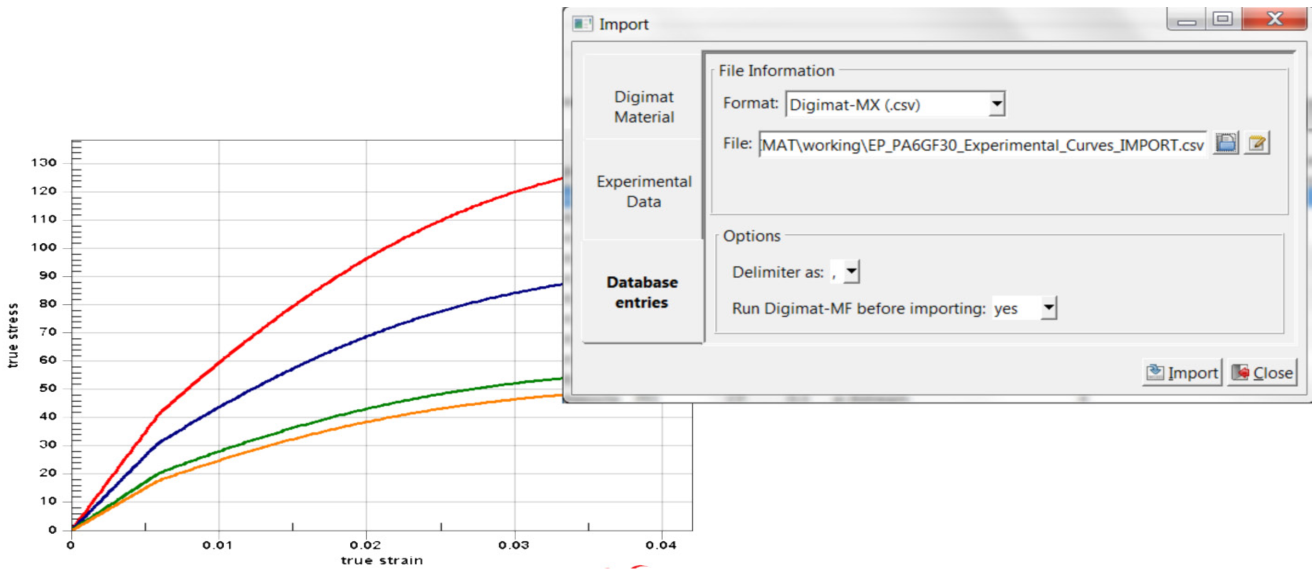
Additional Digimat-MX tools

- Data sheet generation of Digimat material models, as well as of experimental files, in pdf format.
- Database summary

Reverse Engineering

Can be done on one or several curves at the same time:

- Various loading angles, strain rates and / or temperatures
- At homogeneous and macroscopic level
- Material models that can be reverse engineered:
  - (Thermo) Elastic
  - Viscoelastic
  - (Thermo) Elastoplastic
  - (Thermo) Elasto-Viscoplastic
- Failure indicators that can be reverse engineered:
  - Maximum stress, maximum strain
  - Tsai-Hill 2D, Tsai-Hill 2D in strain
  - Tsai-Wu 2D, Tsai-Wu 2D in strain
  - Azzi-Tsai-Hill 2D
  - Hashin Rotem 2D
  - Hashin 2D
  - Tsai-Hill 3D transversely isotropic (stress or strain)
- Other features that can be reverse engineered:
  - Aspect ratio of inclusion phase
- Multi-layer microstructures are supported



User friendly & save storage of anisotropic material measurements

Digimat-MAP

Digimat-MAP is a mapping software used to transfer data between dissimilar meshes.

A rich set of embedded tools allows full control over the required workflows:

- Manipulation of meshes
  - Measurement of positions, distances and angles,
  - Manual superposition,
  - Automated superposition
- Transfer of data
  - Fiber orientation, volume fraction & aspect ratio
  - Temperature
  - Residual stresses
  - Location of weld lines
- Quality Assessment
  - Global & local error analysis
- Visualization & Post-Processing
  - Display of mapped microstructure (scalar, tensor vector & ellipsoidal plot)
  - Investigation of local stiffness

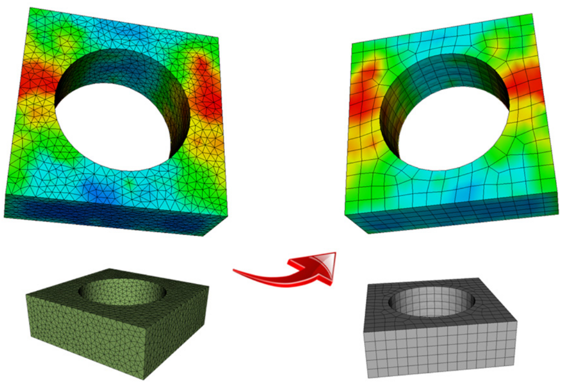
New Capabilities

- New automatic mesh superposition algorithm with improved robustness

Main Capabilities

Data Types Managed

- Fiber orientation: Orientation tensor / Woven (warp / weft)
- Fiber length: Aspect ratio
- Volume fraction: Fibers / Voids
- Residual stresses
- Temperatures
- Weld Lines



Mapping of data between dissimilar meshes

Element types

- Donor
  - Tetrahedron or triangular shell elements
  - Hexahedron and wedge elements

- Receiver
  - Tetrahedron or triangular shell elements
  - Hexahedron or quadrangular shell elements
  - Wedge elements

Shell & 3D Mapping

- From midplane to multi-layered shell
- Between Continuum 3D elements
- Across the shell thickness
- 3D to shell mapping

Data Post-Processing

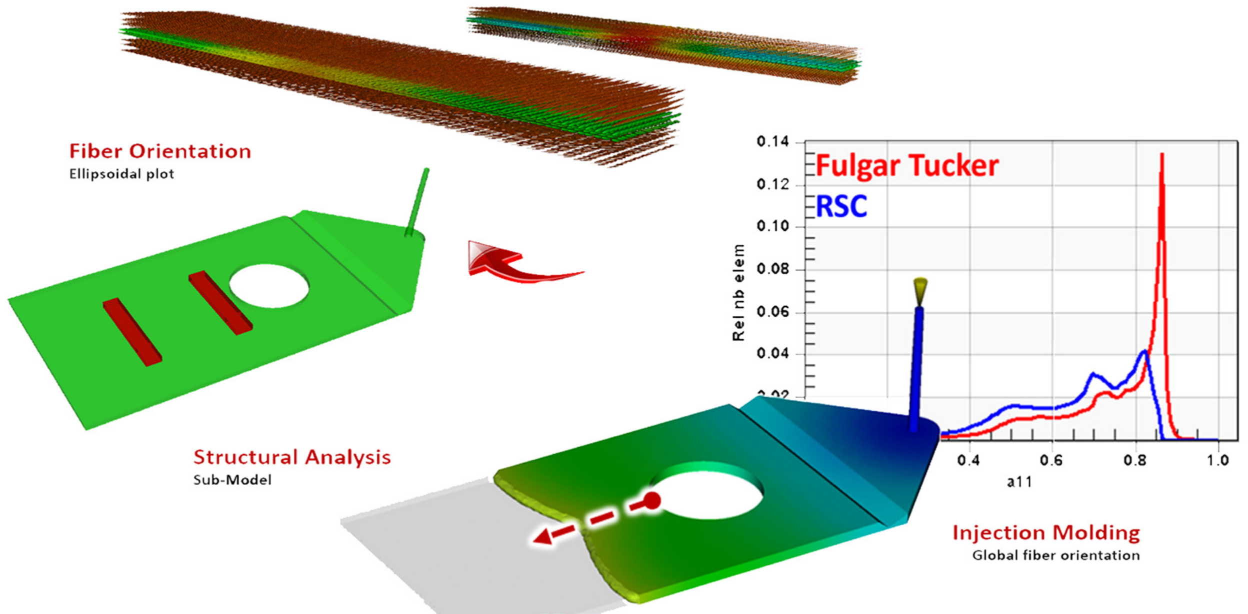
- Contour or vector plots
- Display tensorial fields using ellipsoids
- Synchronized display of donor and receiving meshes
- Through-the-thickness orientation or temperature plot for shell elements
- Cut plane on 3D meshes
- Superposition display of the donor with the receiving meshes

Error Indicators

- Global & local error indicators to validate mapping quality

Donor-Receiver Positioning

- Scaling, Translation, Rotation, Superposition



Local visualization and global analysis of fiber orientation data after mapping

Digimat-CAE

Digimat-CAE centralizes the upstream and downstream interfaces for Digimat material models and bridges the gap between processing and final composite part performance.

It is the central tool used for building coupled multi-scale analyses based on the manufacturing process.
Local microstructure is taken into account and translated into a macroscopic material response. This results in a highly accurate prediction of the final performance of the composite part.

Digimat-CAE offers GUI guidance for the set-up of integrative simulations and supports this approach via embedded Plug-Ins in native FEA environments. Choices of Digimat multi-scale solution methods (MACRO/MICRO/HYBRID) allows the individual to balance the need for accuracy and fast computation.

New Capabilities

- Progressive failure
  - Multiple damage laws with a single failure indicator
  - Significant CPU time reduction for UD/shell/explicit simulation configurations

- Hybrid Solution
  - Minimization of the number of state variables
  - Support of unbalanced woven
  - Thermally dependent failure strengths in TE & TEP
  - Support of thermo-viscoelastic models
  - Hybrid parameter reader and viewer allowing to compare hybrid & micro responses
  - Failure
- Strain based failure criterion allowing to differentiate tension and compression based on triaxiality.

  - General CPU time reduction
- Significant for shell elements
- Minor for solid elements
- New outputs for UD materials
  - Fraction of failed/non-failed integration points through the thickness of shell elements

- Interfaces to FEA
  - Nastran
- Support of version 2014 (Windows / Linux 64bit)
  - Abaqus
- Support of version 6.14 (Windows / Linux 64bit)
  - Dyna
- Support of version 6.1.2 (Linux 64bit)
- Support of version 7.1 (Windows / Linux 64bit)
- General robustness improvements
  - Ansys
- ACT plugin for Ansys WB

Anisotropic multi-scale material modeling for accurate design simulations

Post-Processing

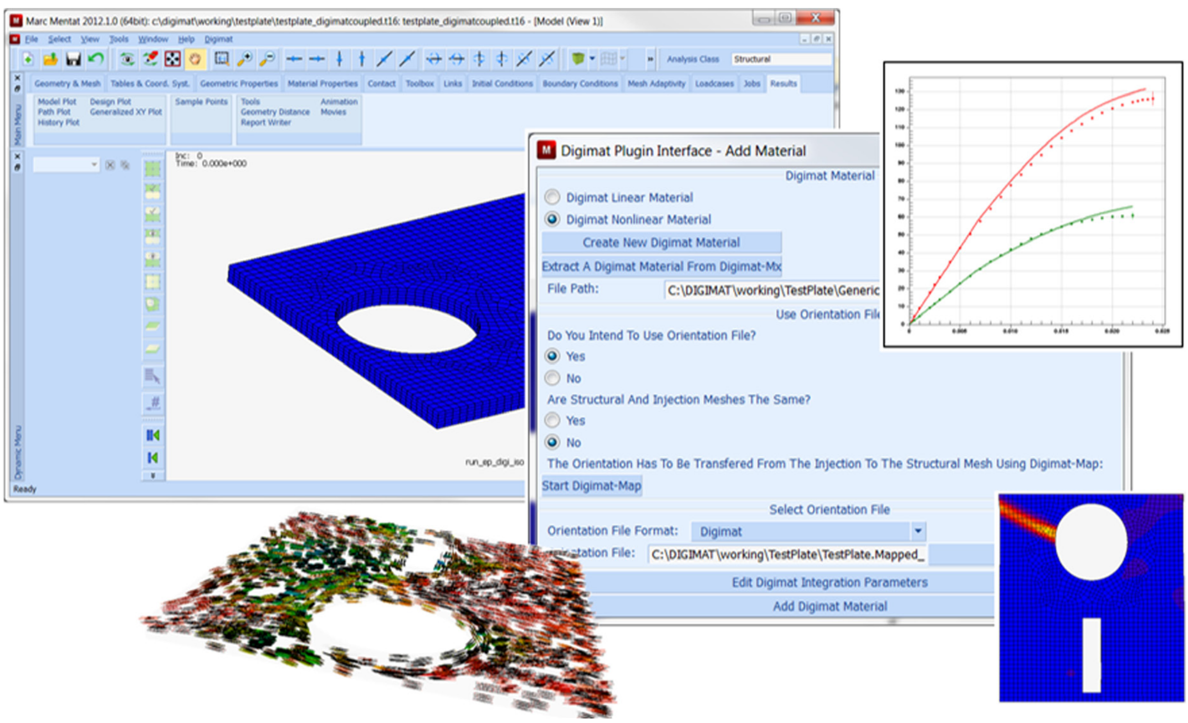
- Micro
  - Default & customized material output
  - Design output related to the fiber orientation
- Hybrid
  - Reduced number of material output
  - Design output related to the fiber orientation

Digimat-CAE/Fatigue

- Multi-axial S-N curves taking into account the fiber orientation
- Coupled interfaces with:
  - nCode DesignLife
  - Virtual.Lab Durability

Digimat-CAE/Structural

- FEA solver types:
  - Explicit
  - Implicit
- Micromechanical Material Model:
  - Linear
  - Nonlinear
  - Rate dependent
  - Thermo dependent
  - Finite strain
- Weak coupling
- Hybrid:
  - E, EP, EVP, TE, TEP, VE, VEVP material
  - Standard per phase failure and FPGF at the composite level - except for TE/TEP
  - Short fiber, UD, Woven
- Strong coupling interfaces to FEA:
  - Abaqus Standard & Explicit
  - ANSYS Mechanical
  - LS-DYNA, Implicit & Explicit
  - Marc
  - Nastran SOL400 & SOL700
  - Optistruct
  - PAM-CRASH
  - RADIOSS
  - SAMCEF (Mecano / Dynam)



User friendly Digimat plug-ins into native CAE environments

Digimat-RP

Digimat-RP is a solution for the virtual design of injection molded fiber reinforced plastic parts.

Lightweight engineering re-designs metal parts into fiber reinforced plastics produced by injection molding. For reinforced plastics manufacturing procedures influence the material microstructure. The effect of local fiber orientation leads to a distribution of material properties over the par. This can drastically influence its final performance and must be taken into account in the design procedures.

Multi-scale simulations read local fiber orientations from injection molding simulations and feed them into a micromechanical material model. The distribution of local properties is taken into account in the computation of the final performance of the part.

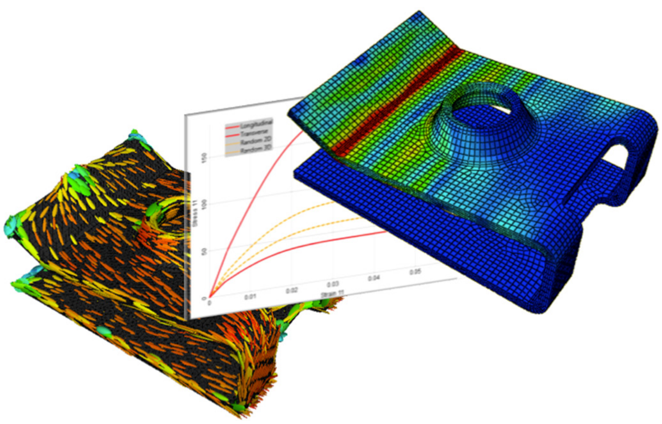
Digimat-RP allows to:

- Load finite element analyses of a broad range of different solvers
- Assign a micromechanical material model to a specific part
- Choose a robust & fast multi-scale simulation method for a coupled analysis
- Map local microstructure information onto the part
- Launch & monitor the coupled analysis
- Access the results of the multi-scale simulation

New Capabilities

- Graphical engine
  - Improved CPU and memory performance
  - Visualization of orientation using vector/ellipsoidal plots
- Mapping
  - Access to new mesh superposition algorithm with improved robustness
  - Optional 1D mapping to define the desired number of layers and their thickness distribution in shell structural mesh

- Interfaces
  - Pam-Crash
  - SOL1XX - Weak coupling for elastic models

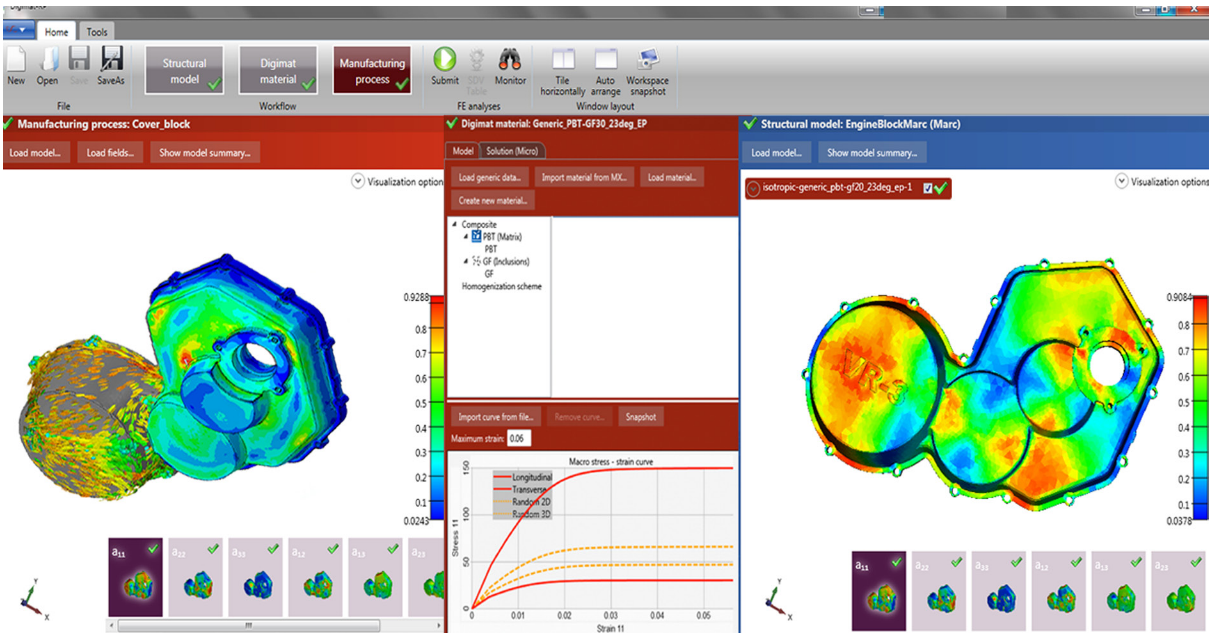


Bridging the gap between injection molding and structural simulations

Main Capabilities

- Easy setup of 3D & shell coupled analyses
- Processing
- Injection / Injection-Compression / Compression molding Software
    - Moldflow
    - Moldex3D
    - Sigmasoft
    - Timon3D
    - REM3D
    - SIMPOE
- Material
    - 2-phase materials
    - Short & long fiber reinforced plastics
    - Input
        - Generic
        - From Digimat-MX (Support of encryption)
        - From Digimat-MF (From File (.daf & .mat)

- FEM solvers
    - Marc
    - MSC Nastran (SOL 1XX, SOL400 & SOL700)
    - Abaqus (Standard & Explicit)
    - Ansys
    - LS-Dyna (Implicit & Explicit)
    - Samcef
    - Radioss (solid only)
    - Pam-Crash
- Solution methods:
    - Macro, Micro, Hybrid
    - User defined templates
- Job management
    - Submission
    - Monitoring



User friendly setup of multi-scale analyses in Digimat-RP

Digimat-HC

Digimat-HC is the solution for the virtual design of honeycomb composite sandwich panels.

The performance of composite sandwich panels depends on the properties of the skin and the core. These are determined by the choice of the underlying microstructure. The core is sensitive to the structure of the constituting honeycomb. The composite skins performance is dependent on the seected fiber type and stacking orientation of the layers. Design choices are typically investigated in bending and shear tests.

The virtual design of a composite sandwich panel requires a multi-scale modeling strategy to be able to map the effect of the microstructure onto the macroscopic performance of the panel. In a coupled analysis the full setup of the panel can be varied and the impact on the final performance under bending and shear investigated in an easy & efficient way.

Digimat-HC allows the user to:

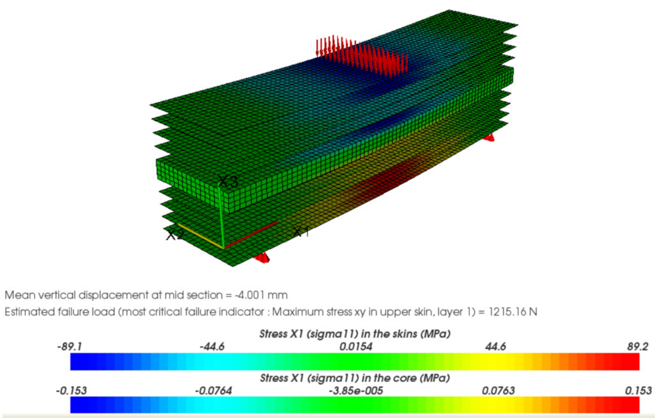
- Set up the structure of a composite sandwich panel
- Define the properties of the core (honeycomb & foam)
- Define the properties of the skins (UD, woven & chopped fibers)
- Investigate the panel design under different scenarios (3-/4-point-bending & shear)
- Flexibly access the results of the analysis (field plot & through-thickness path analysis)

Main capabilities

Skin Definition

- Pile up:
  - Symmetric
  - Anti-symmetric
- Material properties:
  - Orthotropic elastic properties of the ply
  - Ply orientation
- Resin/Fibers:
  - Isotropic elastic properties of the resin and fibers
  - Fiber weight fraction, length and orientation

The equivalent, homogenous, properties of the skins are computed using micromechanics.



Stress response of a composite sandwich panel exposed to three-point bending

FEA Model

- Automatic mesh generation following selected mesh refinement:
  - Coarse
  - Average
  - Fine
- Loading:
  - Three-point bending
  - Four-point bending
  - In-plane shear

Customized positions and amplitudes for loading points and fixations.

Core Definition

- Honeycomb: honeycomb properties are computed using micromechanical models based on the cell geometry and the bulk properties
- Foam

Post-processing

Integrated post-processing including 3D and through-thickness views of stresses, strains and failure indicators.

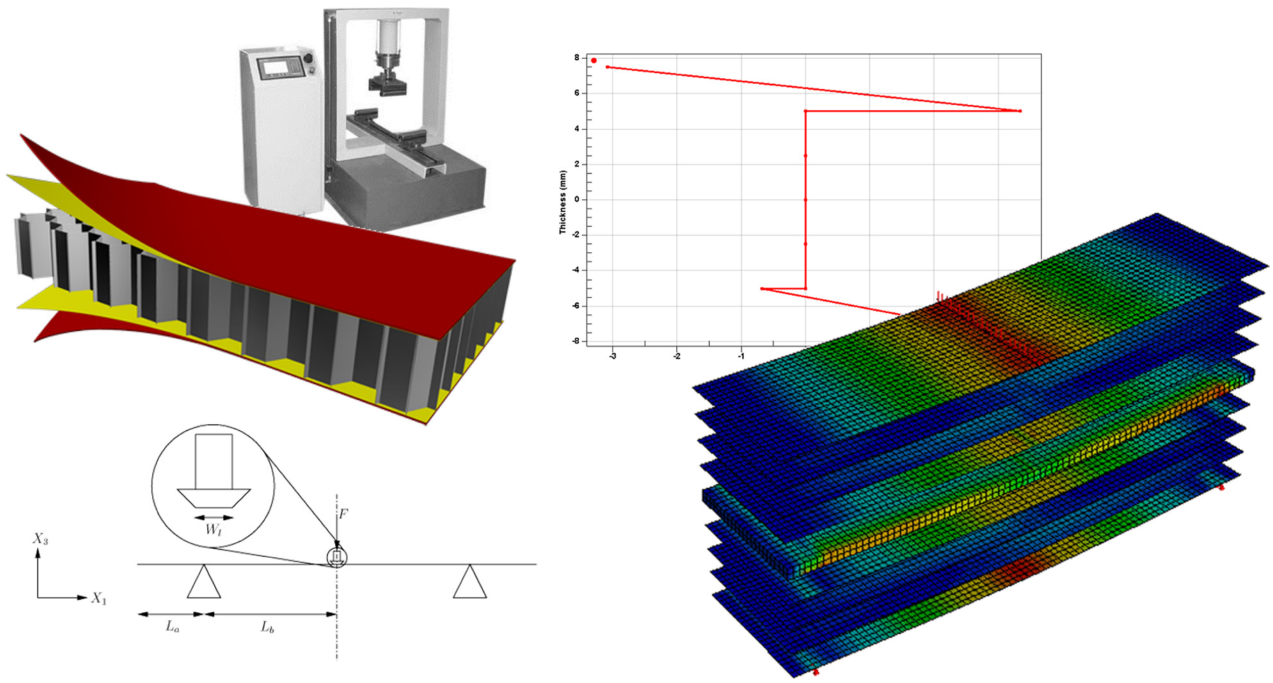
Failure Indicators

- Core:
  - Maximum stress (compressive, shear)
- Skin:
  - Maximum stress
  - Tsai-Wu
  - Tsai-Hill
  - Azzi-Tsai-Hill

Automatic Report Generation (html)

Automatic Generation and Solving of the FEA

Model using a Built-in FEA Solver



Digimat-HC – Virtual test environment for composite sandwich panels

Digimat-VA

Digimat-VA ("Virtual Allowables") is an efficient solution that empowers engineers to virtually compare materials before going into the lengthy physical allowables. By generating virtual allowables, engineers can now start the component design in parallel to the physical allowable campaign.

Digimat-VA is a vertical solution is developed to compute, instead of test, the behavior of composite coupons (unotched, open hole, filled hole, …) to screen, select and compute the allowables of composite materials.

Digimat-VA...

- It defines test matrix in a few clicks
- It creates multiscale material models based on composite datasheet
- It models batch and process variability
- It can go beyond recommended CMH17 procedures
- It turns a test matrix into FEA runs to obtain virtual allowables

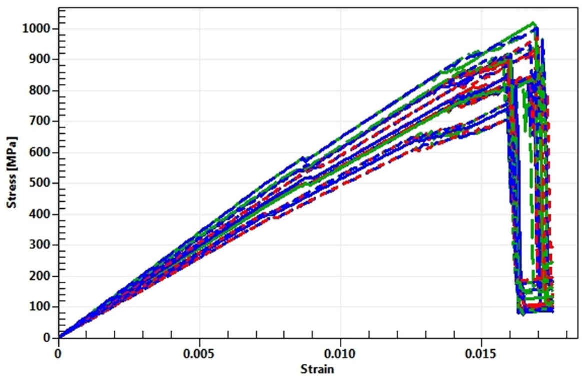


Figure 1: Stress-strain curves extracted from coupon simulations including variability

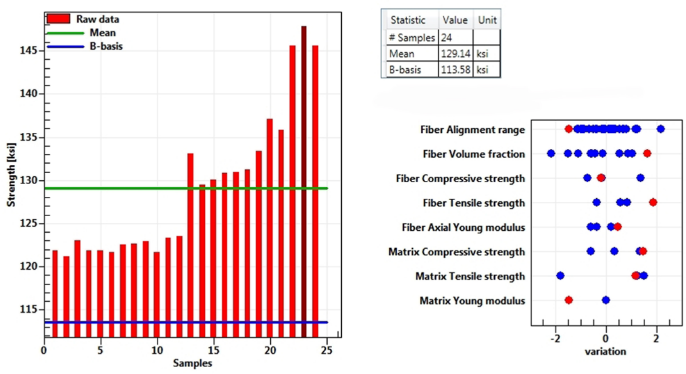


Figure 2: A and B-basis are computed from the raw strengths results

Main Capabilities

- Prediction of allowables
  - UD materials
  - Unnotched tension/compression and open-hole tension/compression tests
- Test matrix preparation
  - Definition of materials, layups, tests, environment condition
  - Definition of sampling (number of batches, panels and specimens)
- Simulation preparation
  - Import of Digimat model including progressive failure
  - Calibration of Digimat model from data sheet
  - Definition of micro-level variability
    - Gaussian distributions
  - Definition of FEA settings
    - Mesh size, element type, meshing strategy, number of timesteps
  - Generation of FEA models
    - Preview mesh
    - Preview random draws
- Simulation run
  - Embedded solver for local run
  - Job management
- Job prioritization
- Monitoring
- Post-processing
  - Automatic extraction of stress-strain curve, stiffness and strength
  - Computation of A, B-basis and mean values for strength following CMH17 procedures
  - Strength and stiffness distribution plots
  - Visualization of stress, strain and damage fields on coupon model
  - Creation of a customized report
  - Export of raw results to Excel
- Additional functionalities
  - Save Digimat-VA project
    - light or complete
  - Management of working database
    - materials, layups, tests, conditions and FEA settings

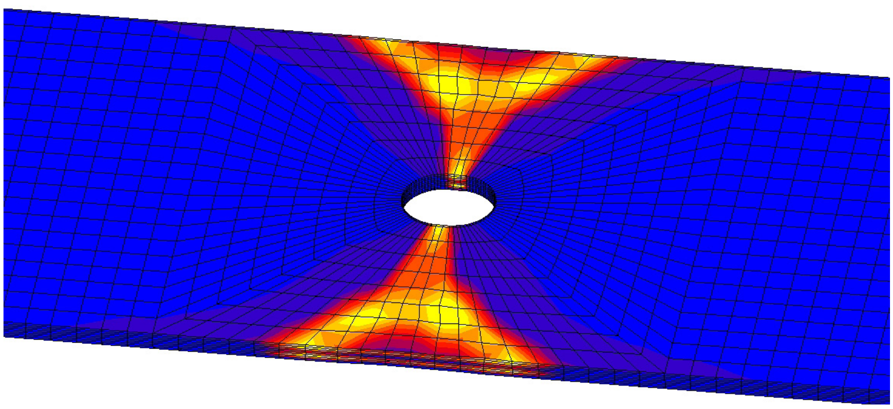


Figure 3: Visualization of fiber damage in an open-hole tension specimen

Trainings

e-Xstream engineering provides a complete training service with the Digimat software package. The aim is to transfer knowledge about the best practices of Digimat usage.

Digimat trainings are organized regularly in Europe, USA and Asia. The training offer includes Beginner and Advanced levels targeting the topics of Material Engineering (focus on Digimat-MF, Digimat-FE and Digimat-MX) and Structural Engineering (focus on Digimat-RP, Digimat-MAP, Digimat-CAE and Digimat-MX, ...).

These training courses are a combination of presentations and live product demos followed by practical hands-on sessions. They aim at answering the users' questions and also include the best practices on how to use Digimat new capabilities.

e-Xstream engineering also offers customized trainings, 100% tailored to the customers' specific needs and organized at the customer site. These trainings are a combination of theory, product presentation followed by an assisted hands-on session. Besides general training and technology transfer the aim is to directly set up customer specific models.

Contact our Training Services team at support@e-Xstream.com!

Engineering Services

COMPOSITES eXperts
Engage. Solve. Deliver.

The pressure for achieving major weight reductions has been around for a few years and keeps increasing. A solution to most industries consists in innovating on the use of composites in applications known to be restricted to other materials such as metals. For other industries, composites are already used extensively but a lack of control on their exact properties limit users' ability to optimize designs and develop new composite solutions. Virtual prototyping is absolutely necessary to efficiently drive, with confidence, those types of engineering innovations; it serves at fully understanding and mastering both the processing of composite parts as well as their end performances.

Thanks to the Digimat technology that plays a key role in accurately modeling composite materials and parts in the virtual prototyping phase, the product development process is speeded up and product designs are better optimized. But having access to the right products isn't always sufficient; it is important to understand when and how to use it, as well as to render it user-friendly via the elaboration of clear and straightforward procedures helping anyone in the company to use Digimat in its daily life.

With its more than 11 years experience in the field of composite modeling, e-Xstream is composed of an extremely skilled engineering team with broad knowledge and expertise in various types of engineering disciplines across all industries.

Various disciplines:

Process simulation: Injection and compression molding, drape molding, RTM, …
Structural simulation: Static, Dynamic (impact & crash), Modal, Fatigue, Creep, …
Various industries: Aerospace, Automotive, Consumer Electronics, Material Suppliers, … Various CAE software: MSC software, Abaqus, Altair, ANSYS, Autodesk Moldflow, LS-Dyna, PAM-CRASH, RADIOSS and SAMCEF.

Thanks to this outstanding team, e-Xstream is proud to offer consulting support, for any type of composite engineering work, based on your specific needs and requirements. This could range from performing analysis for you on a project basis; one or two times a year, or providing full time staff members to help you create repeatable processes in-house.

The Engineering Services team works closely with customers to support their specific needs in getting more accurate predictions of the micro-mechanical behavior of composite materials and parts.

Contact our Engineering Services team at engineering.services@e-Xstream.com!

www.e-Xstream.com
info@e-Xstream.com