digimat to LS-DYNA

Version 3.1.1 – June 2008

DIGIMAT™ to LS-DYNA®, Multi-Scale modeling of the impact and failure of composite structures

The interface between DIGIMAT and LS-DYNA offers LS-DYNA users the capability to perform accurate explicit FEA of composite structures where DIGIMAT-MF is used to model the nonlinear, anisotropic and rate-dependent behavior of the composite material.

DIGIMAT is a nonlinear multi-scale material and structure modeling platform that can be used to predict the behavior of multi-phase materials such as reinforced plastics, filled rubbers, hard metals, graphite,…and structures made out of these materials.

DIGIMAT-MF is the Mean-Field homogenization module of DIGIMAT which offers the capability to define the composite material behavior as a function of:

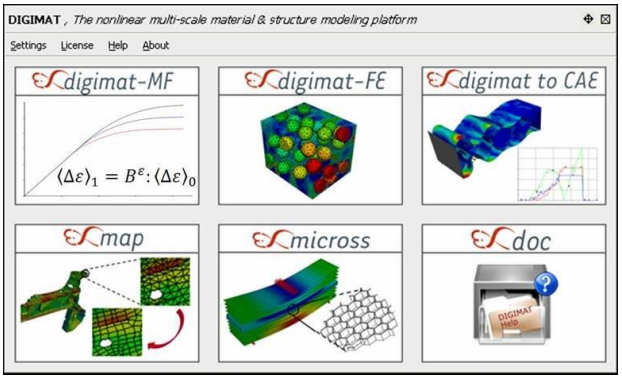
1) the material behavior of the matrix and inclusion phase(s);
2) the composite microstructure morphology.

DIGIMAT-FE is the Finite Element based tool for the nonlinear micromechanical modeling of realistic Representative Volume Element (RVE) of complex material microstructures.

DIGIMAT to CAE is the multi-scale structural modeling tool that groups the interfaces between injection molding software, DIGIMAT-MF and structural analysis software.

MAP is a 3D mapping software used to transfer the fiber orientation, residual stresses and temperatures from the injection molding mesh to the structural analysis mesh.

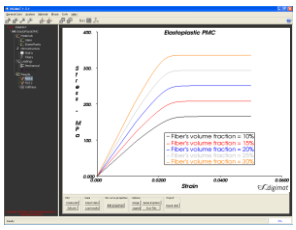
MICROSS is a user-friendly tool for the design of composite sandwich structures with honeycomb core.

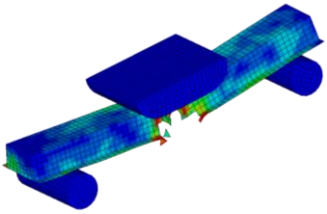


DIGIMAT to LS-DYNA is the strongly-coupled interface from DIGIMAT-MF to LS-DYNA via the USER DEFINED MATERIAL capability. DIGIMAT-MF is provided as a software library that is linked to LS-DYNA to offer a strong multi-scale coupling between the nonlinear micromechanical material modeling capabilities of DIGIMAT-MF and the nonlinear explicit FEA capabilities of LS-DYNA. In this configuration, DIGIMAT-MF acts as an advanced anisotropic, nonlinear and rate-dependent user defined material at each relevant integration point of the LS-DYNA FE mesh.

digimat-MF

digimat to LS-DYNA





LSTC Livermore Software Technology Corp.

MAJOR BENEFITS

Accurate Micromechanical Material Modeling:

- *Anisotropic*, corresponding to the local microstructure morphology
- *Nonlinear*, elasto-plastic with continuous damage
- *Rate-dependent*, visco-elastic or elasto-viscoplastic matrix.

Accurate Nonlinear Multi-Scale Structure Modeling:

- *Heterogeneous*, corresponding to local microstructure morphology
- *Optimal mesh refinement, element choice & solution strategy.*

Efficient & User-Friendly Solution Procedure:

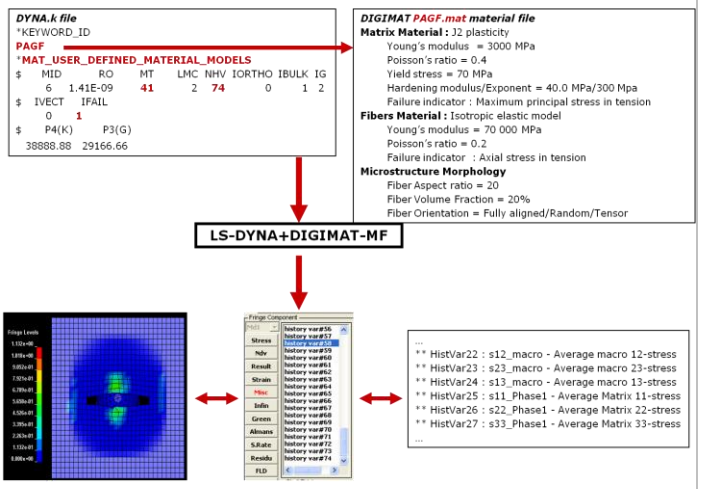
- *Streamlined* multi-scale modeling procedure
- *Intuitive* graphical user interface.

Accurate Failure Prediction :

- *Micro & macro* failure indicators.

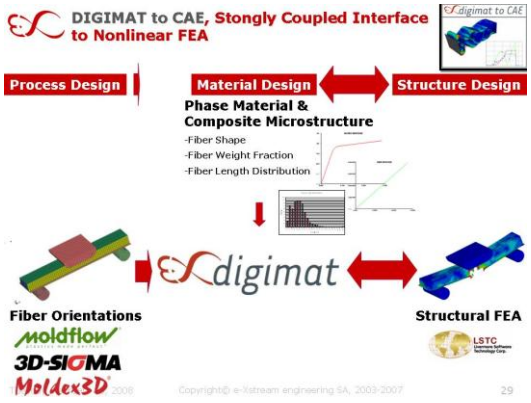
DIGIMAT to LS-DYNA Interface:

- DIGIMAT-MF is strongly coupled to LS-DYNA using the MAT_USER_MATERIAL_MODELS.
- From LS-DYNA, the material is simply referenced by a *MaterialName* that corresponds to the *MaterialName.mat* file generated by DIGIMAT-MF and which contains the micromechanical material definition.
- LS-DYNA and DIGIMAT-MF are linked together to build a unique LS-DYNA executable where DIGIMAT-MF computes the nonlinear, anisotropic and rate-dependent material response at each integration point of the structure.
- The results of the DIGIMAT to LS-DYNA multi-scale analyses are available in the LS-DYNA output file at the composite level (macro scale) and in each phase (micro scale, e.g. in the matrix and fibers).



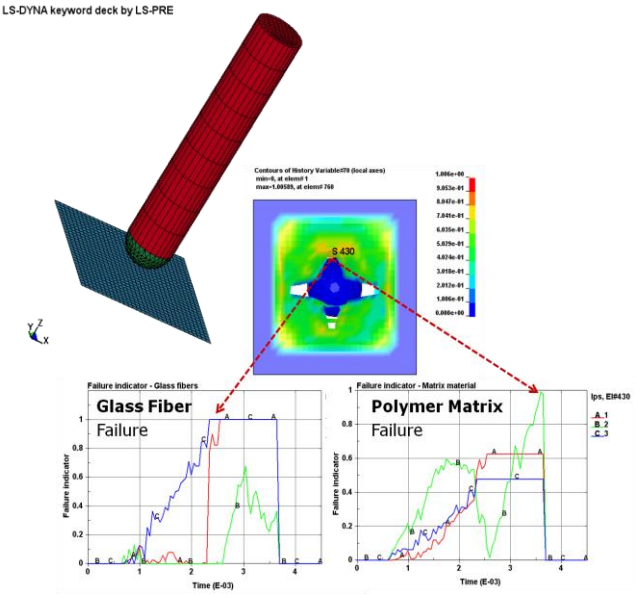
DIGIMAT to LS-DYNA for Reinforced Plastic Parts:

- DIGIMAT is interfaced to Moldflow®, Sigmasoft® and Moldex 3D® injection molding software to enable an accurate and efficient LS-DYNA FEA of fiber-reinforced plastic parts, where DIGIMAT-MF is used to model the nonlinear, anisotropic and rate-dependent behavior of the part, while taking into account the fiber orientation, residual stresses and temperatures predicted by the injection molding software at each point of the structure.



Failure of Reinforced Plastic Parts:

- DIGIMAT to LS-DYNA enables an accurate prediction of the failure of reinforced plastic parts subject to impact loading. This is possible thanks to DIGIMAT-MF's capabilities to model:
  1. rate-dependent (i.e. visco-elastic and elasto-viscoplastic) material response;
  2. material anisotropy induced by the reinforcement (e.g. fibers) orientation;
  3. local material heterogeneity induced by the underlying material microstructure (i.e. fiber length, fiber content).
- A comprehensive set of failure indicators are available in DIGIMAT-MF and can be applied to the composite (macro scale) and/or to the matrix and/or fiber phases (micro scale). These macro and micro failure indicators will drive the element deletion in LS-DYNA.



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