

Thermo-mechanical design of an ultra-light satellite antenna

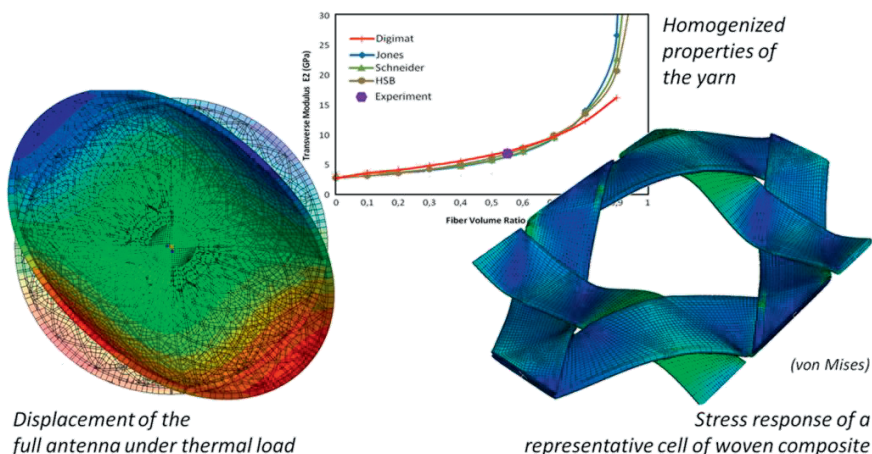
CUSTOMER: ESA ESTEC

- The ESA ESTEC (European Space Research and Technology Center) is the incubator of the European space effort
- The ESA ESTEC supports European space industry and works closely with universities, research institutes and space agencies all over the world
- The ESA ESTEC implements R&D studies to develop technologies for future space missions

CHALLENGE

- Satellite antennas have to be designed in a sturdy and reliable manner
- There is no easy way to repair a satellite once it breaks down
- The extreme sensitivity of the structure towards thermal loads has to be investigated under environmental conditions

HOW CAN DIGIMAT SUPPORT VIRTUAL DESIGN OF ULTRA-LIGHT SATELLITE ANTENNA?



DIGIMAT SOLUTION

- Multi-scale modeling of advanced woven composite material on 3 scales
- Carbon/epoxy composite: homogenization of yarn properties
- Triaxial woven fabrics (TWF): detailed analysis of a representative cell
- Satellite antenna: simulation of the full structure based on an equivalent multi-layer shell model representative for TWF

RESULTS

- Mean-field homogenization gives high quality prediction of yarn properties (stiffness & CTE)
- Yarn properties used to compute accurate results for stiffness & CTE for TWF
- Good prediction of displacement behaviour of the satellite antenna due to thermal loading

MATERIALS

Woven composites

PERFORMANCES

Stiffness, CTE

DIGIMAT

Digimat-MF, Digimat-CAE

CAE TECHNOLOGY

Abaqus

INDUSTRY

Aerospace

APPLICATION

Robustness



Venus Satellite, Courtesy of ESA/ESTEC

“DIGIMAT is able to bridge the micro to the Macro world. A great example of high-quality European know-how”

Dr Julian Santiago Prowald,
TEC-MSS Structures Section
ESA/ ESTEC

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.

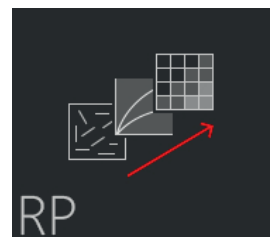
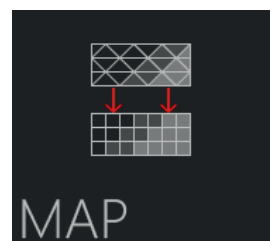
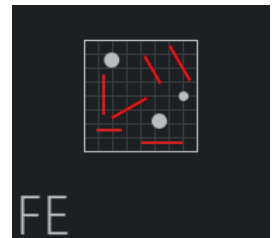
Digimat MX: Material eXchange platform used to prepare, store, retrieve and securely exchange Digimat material models between material suppliers and end-users.

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 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.