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RIGHT RESULTS. RIGHT AWAY.

OVERVIEW

SwiftComp™ provides an efficient, accurate tool for modeling composites. It can be used independently for virtual testing or as a plugin to power conventional FEA codes with high-fidelity modeling. SwiftComp implements a true multiscale theory, which assures the best models at the speed of engineering design, to capture details as needed and affordable. This saves orders of magnitude in computing time and resources without sacrificing accuracy, while enabling engineers to tackle complex problems impossible with other tools.

SwiftComp™

UNIQUE TECHNOLOGY

SwiftComp implements the novel Mechanics of Structure Genome, unifiying both composite micromechanical and structural modeling. SwiftComp differs drastically from the conventional micromechanics-then-structural mechanics approaches. The principle of minimum information loss (PMIL) is used to avoid a priori assumptions commonly invoked in other approaches, providing the most mathematical rigor and the best engineering generality. The original problem is decoupled into two sets of analyses: a constitutive modeling and a structural analysis, allowing the structural analysis to be formulated exactly as a general (1D, 2D, or 3D) continuum, the analysis of which is readily available in commercial FEA software packages. This also confines all approximations to the constitutive modeling, the accuracy of which is guaranteed to be the best by PMIL. SwiftComp provides a seamless, high-fidelity link between constituent material properties and engineering structural design and analysis.

KEY BENEFITS

- Harness the full potential of composites in your design by capturing both anisotropy and heterogeneity as needed and affordable.
- Use structure genome to reduce engineering time orders of magnitude.
- Infuse 1st principle 3D FEA fidelity into earlier design stages at the efficiency of simple engineering models, while minimizing information loss.
- Simplify acquiring, training, and use of your composite simulation tools by unifying micromechanics and structural mechanics into a single technology.
- Get the most out of your conventional FEA packages as SwiftComp empowers them with high-fidelity multiscale modeling for composites.
- Reuse your tools for design and analysis of metals by providing a right approach to model composites as a homogeneous continuum capturing all the microscopic details.

APPLICATIONS

MULTISCALE MODELING OF COMPOSITES

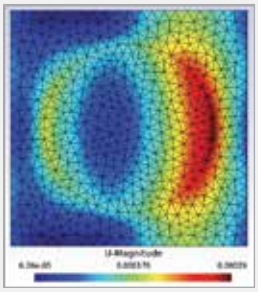
- 3D composite structures: binary composites, fiber reinforced composites, particle reinforced composites, textile composites, short fiber composites, porous materials, foams, and other heterogeneous materials
- Composite plates/shells: laminates, stiffened panels, corrugated structures, perforated structures, sandwich structures, unitized structures, and more
- Composite beams: helicopter rotor blades, wind turbine blades, high-aspect wings, golf clubs, fishing rod, and other slender composites structures

VIRTUAL TESTING OF COMPOSITES

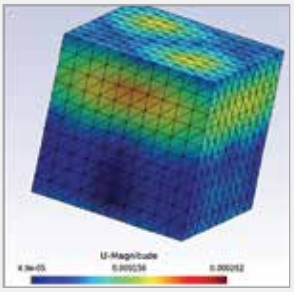
- Mechanical properties: elastic constants, static strength
- Conductivities, dielectric, magnetic, and diffusive properties
- Coefficients of thermal expansion and specific heat
- Electromagnetic properties

	ANSYS 3D FEA	SWIFTCOMP
Element Type	Solid186	8-noded Quad
Number of Elements	362,408	2,459
Number of Nodes	1,638,866	7,965
Running Time	3h 5m 23s	37s

▲ SWIFTCOMP IS **300 TIMES MORE EFFICIENT**, WITHOUT A LOSS OF ACCURACY



Square pack microstructure dehomogenization



Spherical inclusions microstructure (3D) dehomogenization

SWIFTCOMP FOR 3D STRUCTURES (MICROMECHANICS)

- Most efficient homogenization and extremely fast dehomogenization
- Obtain full set of properties in one analysis with no need to apply load and boundary conditions.
- Obtain full set of local fields through simple matrix multiplications.
- Obtain 3D properties and local fields from a 2D structure genome for unidirectional composites and a 1D structure genome for binary composites.
- Handle all heterogeneous materials with a single theory.
- Model periodic, partially periodic, and aperiodic materials.
- Achieve faster convergence than FEA due to SwiftComp's semi-analytical nature.
- Obtain local fields for the composites subjected to complex 3D states.

SWIFTCOMP FOR COMPOSITE PLATES/SHELLS

- Compute the best plate/shell stiffness matrices for a given choice of structural model.
- Achieve the accuracy of high-order layerwise theory with the efficiency of first order shear deformation theory for composites laminates.
- Handle plates with in-plane heterogeneities, such as sandwich structures, corrugated structures, stiffened structures.
- Use as a user material model for other FEA software to enable high-fidelity composite modeling using standard plate/shell elements.
- Perform plate/shell modeling starting from lamina properties or constituent properties.
- Predict failure at the constituent level.

SWIFTCOMP FOR COMPOSITE BEAMS

- Model slender structures with ply-level details using the simple beam theory without losing accuracy compared to 3D FEA.
- Capture all the elastic coupling of composites using a beam theory.
- Compute the best beam properties needed in system level analysis, such as multibody dynamic simulation of helicopters or wind turbines.
- Model structures with spanwise heterogeneities, such as buildup wings,
- Use as a user material model for other FEA software to enable high-fidelity composite modeling using standard beam elements.
- Perform beam modeling starting from lamina properties or constituent properties.
- Predict failure at the constituent level.