

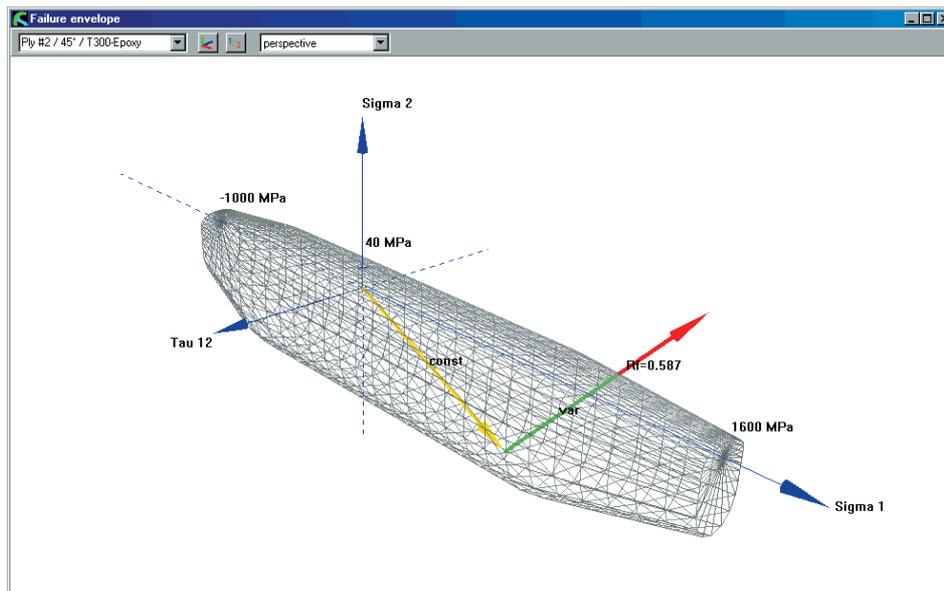
# COMPOSITE STAR

DESIGN SOFTWARE & DATABASE  
FOR COMPOSITE MATERIALS & LAMINATES

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[www.etamax.com.au/composite\\_star.html](http://www.etamax.com.au/composite_star.html)

COMPOSITE STAR is an all-embracing laminate design and materials database software package for composite materials. It calculates:

- ✓ the mechanical / thermal / hygroscopic properties of composite plies for any combination of fibre and resin
- ✓ the mechanical / thermal / hygroscopic properties of laminates for any sequence of plies and any combination of materials
- ✓ laminate load response and failure predictions using a choice of industry standard and newer failure criteria and progressive ply failure models



3D model of a failure envelope with constant and variable stress vector

## FEATURES

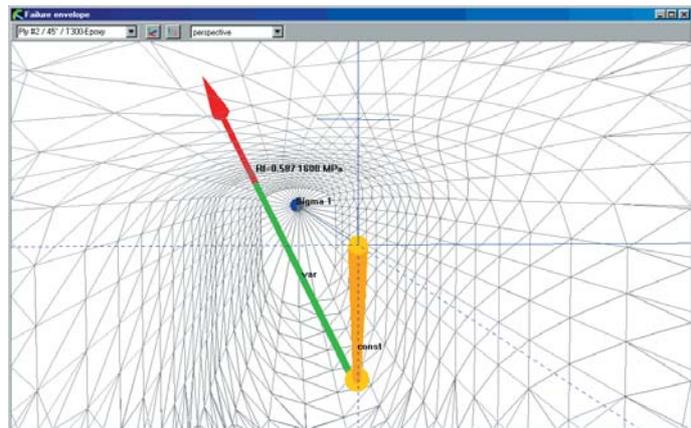
### Laminate load response

Laminate loads consist of external mechanical loads and internal thermal or hygroscopic loads. In order to solve real-world problems, COMPOSITE STAR defines a constant and a variable load. Typically the constant load is a preload (e.g. thermal loads resulting from curing, an external static mechanical load). The variable load is used to define a dynamic external mechanical load. This permits the calculation of the extent to which the dynamic external load can be increased until failure occurs.

### A new failure criterion and simulation of the failure process

COMPOSITE STAR uses the ply-by-ply failure analysis in its most modern and advanced form. Besides the standard failure criteria (maximum stress, maximum strain, simple Puck, modified Puck, Tsai-Hill, Tsai-Wu, Hoffman, Hashin), COMPOSITE STAR introduces one of the world's most detailed and sophisticated interactive criterion, Puck's action plane criterion. This criterion distinguishes between the different fracture modes (tensile and compressive fiber-fracture, tensile, shear and compressive inter fiber fracture), calculates the fracture plane angle for inter-fiber fracture and can predict catastrophic wedge effects.

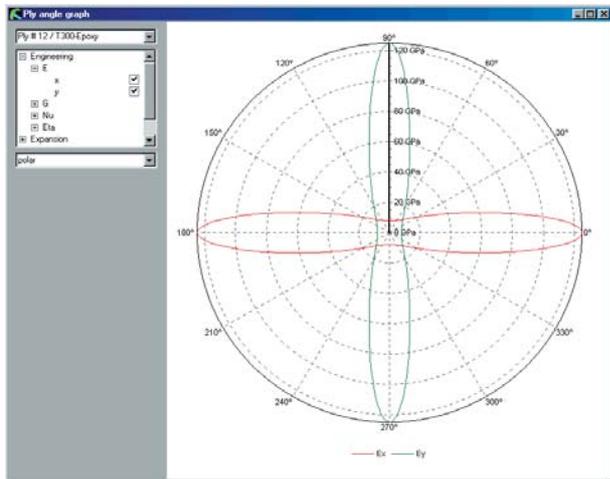
Progressive failure analysis allows strength prediction after first ply failure. COMPOSITE STAR offers progressive failure calculation according to Tsai or the latest failure process and non-linear ply degradation model from Puck. The load will be increased step by step. If a failure occurs, the corresponding ply will be degraded and the new resulting laminate with the new stress and strain distribution will be calculated. All laminate properties, stresses and strains can be observed at every important moment of the load increase. Consequently, the progressive failure calculation results in a real simulation of the failure process.



*View of the 3D failure envelope with stress vectors*

Puck's action plane failure criterion and degradation model has been tested thoroughly by university and industry research laboratories throughout the world and shows a unique conformity with reality. Furthermore, it is the new standard in VDI (Association of German Engineers) guidelines 2014 and is recommended by the IKV (Institute for Plastic Processing), Aachen, Germany and leading composite design experts worldwide.

## The graph engine



*Polar diagram of Young's moduli*

COMPOSITE STAR's sophisticated graph engine allows display of any X-Y or polar graph, including any ply property versus the ply's orientation angle, carpet plots, ply-by-ply stress and strain diagrams and failure process diagrams. An additional and important tool for the designer is the display of the three-dimensional model of the failure envelope and the constant and variable stress vector for each ply. This allows immediate recognition of the stress state and reserve factor in the critical plies.

## The material database

COMPOSITE STAR stores all data in a state-of-the-art, full-featured database. The database stores the data of fibers, matrices, plies, laminates, stacking sequences, loads and structures.

## The user interface

The quality and efficiency of software is only as good as its user interface. Therefore, great importance has been placed on the calculation and database user interface. The different database tables are shown as grids. As with the so efficient spreadsheet programs, the user can change any value at any time and press one single calculation button, which will update all calculations results instantly. Although very sophisticated, the software can be used intuitively without complicated menus, windows or dialogs. Every function is just a mouse-click away.

## Support

MATERIAL has been providing engineering services and software for the composites industry since 1990. It's software system CADWIND has become the industry's standard for filament winding technology. MATERIAL's engineering team has had many years of experience in the design and manufacturing of composites, and can provide you with help and training courses to meet your specific design needs.

## System requirements

COMPOSITE STAR runs on any computer with Windows 98SE, ME, NT, 2000, XP or VISTA.

## SPECIFICATIONS

### Ply calculation

- ✓ ply calculation with fiber/matrix micromechanics
- ✓ all major micromechanics models (rule of mixtures, cylinder model, ...)
- ✓ calculation results: mechanical properties, thermal and hygroscopic expansion coefficients

### Laminate properties calculation for any ply sequence / combination

- ✓ laminate calculation with Classical Laminate Theory (CLT)
- ✓ plies can be isotropic or anisotropic materials
- ✓ calculation results for the whole laminate: thickness, density, stiffness and compliance matrices, in-plane and flexural Young's modulus, shear modulus, Poisson's ratio, Lekhnitskii's coefficients, thermal and hygroscopic expansion coefficients, through-thickness moduli and expansion coefficients, out-of-plane shear stiffness and compliance matrix
- ✓ calculation results for each ply in the laminate (in ply directions or laminate directions): transformation matrices, stiffness and compliance matrices, reduced stiffness and compliance matrices

### Laminate load response calculation

- ✓ external mechanical load definition by forces and moments per unit length, normalized flexural and in-plane stresses or midplane strain and curvatures
- ✓ internal hygroscopic and thermal loads
- ✓ possibility to define a constant and a variable load
- ✓ calculation results for bottom, middle, top of each ply in the laminate (in ply directions or laminate directions): equivalent thermal and hygroscopic forces and moments, actual strains and stresses, hygroscopic and thermal strains and stresses, free hygroscopic and thermal strains, residual hygroscopic and thermal strains and stresses, equivalent strains

## Laminate failure calculation

- ✓ all major standard failure criteria: maximum stress, maximum strain, simple Puck, modified Puck, Tsai-Hill, Tsai-Wu, Hoffman, Hashin
- ✓ new detailed Puck's action plane failure criterion with prediction of the failure mode (tensile and compressive fiber fracture, tensile, shear and compressive inter fiber fracture) and the fracture plane angle for inter fiber fracture with warning against catastrophic wedge effects
- ✓ calculation of the reserve factor and effort for first ply failure for the constant load, variable load and total load
- ✓ calculation of the failure process (progressive failures after first ply failure until last ply failure) according to Tsai or Puck with failed ply degradation and calculation of the degraded laminate

## Graph engine

- ✓ any X-Y or polar graph including ply properties versus ply angle, carpet plots, ply-by-ply stress and strain diagram
- ✓ failure process diagram
- ✓ 3D model of the failure envelope together with the constant and variable stress vector for each ply

## Database

- ✓ full feature database with the following tables: plies, laminates, stacking sequences, loads
- ✓ data stored: physical and engineering parameters

## User interface

- ✓ supports all units including metric and English units
- ✓ units and display format can be chosen for value groups or each value individually
- ✓ efficient and easy spreadsheet style use
- ✓ very simple menu, window and dialog structure
- ✓ customize, save and restore all edit, display and desktop settings
- ✓ runs on any computer with Windows 98SE, ME, NT, 2000, XP or VISTA