HyperSizer Express: *Insanely Fast Laminate Optimization*

95% of users, without user manual, and without instruction, will be able to import their FEM and produce optimum composite laminates that satisfy all analyses to all load cases within the first 10 minutes. Your automatically updated model will have minimum weight and fully producible laminates with global plies identified. These laminates are optimum and they are manufacturable as the software creates the ply shapes layer by layer automatically. The sequenced plies can also be exported to spreadsheets for import into CAD such as CATIA.

The software works fast with large FEMs (millions of elements) and thousands of load cases. Its ability to optimize is ***insanely fast***.

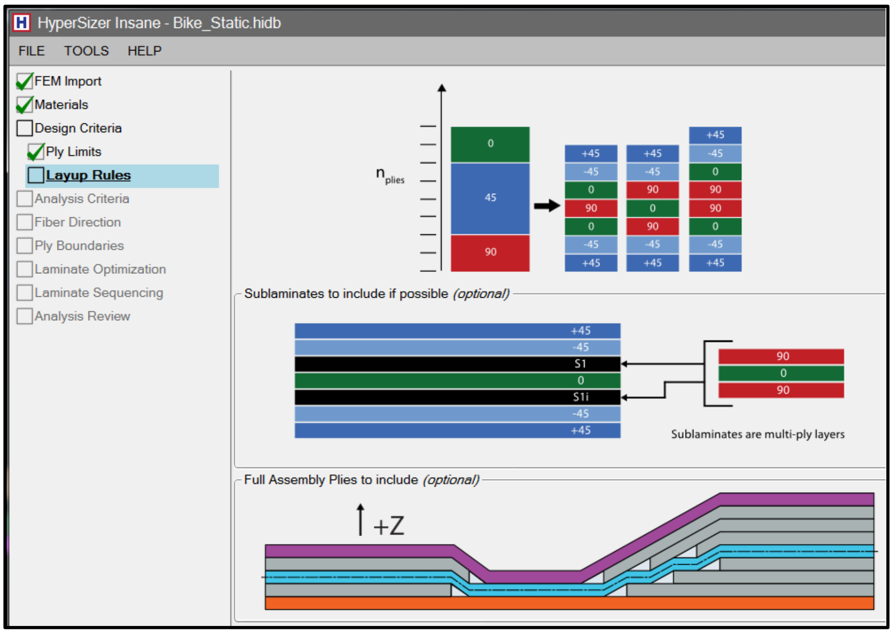
With its ease of use and robust optimization, the software is suitable for the general composite engineer. This includes industries such as:

- Sports (*bicycle frames, snowboards, sailboats*)
- Medical (*equipment, leg/foot prosthesis*)
- Automotive (*Doors, trunks, hoods, body panels, floor panels, body in white*)
- Industrial (*robotic end effectors*)
- Aerospace (*airplane seats, doors, winglets, flaps*)

Aerospace Heritage

HyperSizer Design™ is an airframe engineering analysis software framework and stress reporting documentation tool. It has been used by NASA and aerospace OEMs for 20 years for advanced composites optimization that reduces spacecraft and aircraft weight by 25%.

HyperSizer Express™ provides cost effective and rapid optimization of general structures. We have taken 20 years of aerospace software development and packaged the most enabling technologies into a very easy to use software product.



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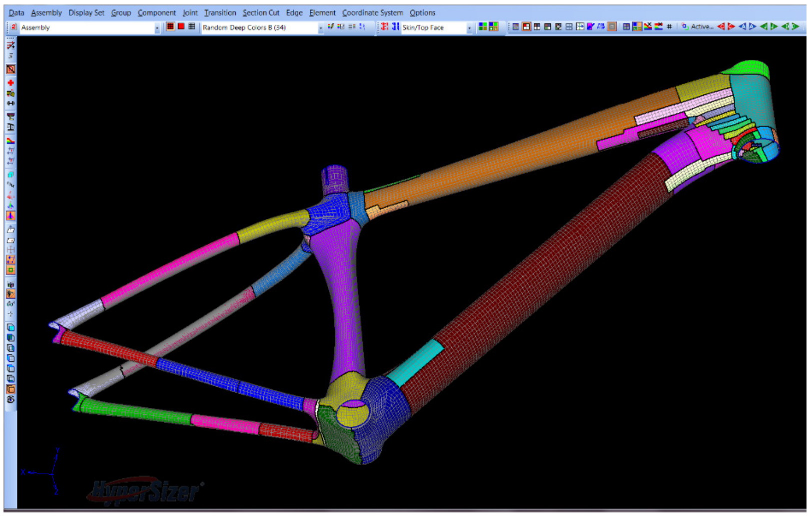
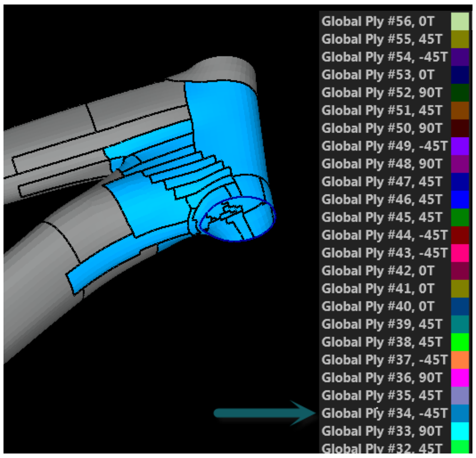


Process

A wizard steps you through the entire process with a series of green check marks on the status console to confirm your current progress. The essential steps are model import, material selection, FEA solver (Nastran/Abaqus) user selection of analysis criteria (failure theory such as max strain or Tsai Wu) and design criteria (such as symmetry and balance and fabrication preferences), laminate optimization and sequencing, reporting of analysis results such as controlling load case, failure mode, and reserve safety factors, and update of your FEM with optimal laminates.

Laminates are optimized for the shape and size of your current definition of FEM property zones (if they exist).

You have the option to try different FEM property zones for additional weight savings. If selected the software optimizes the zone patterns (allowed ply boundaries) and displays them in the graphics along with their weight savings. The user can view all the possible different ways ply shapes could be defined on the mesh.



FEA Loads

The optimization uses all of the FEA computed shell element in-plane membrane forces, out of plane transverse shear forces, and bending moments (Nx, Ny, Nxy, Mx, My, Mxy, Qx, Qy). They result in ply fiber, transverse to fiber, and shear direction stresses. You can select to include FEA solver iterations for static, buckling, and frequency runs. As the optimization redistributes the FEM stiffness's, the iterations will converge the load paths and eigenvalues to meet requirements.

Closed form buckling solutions are used with tight integration with FEA buckling solutions. Buckled mode shape locations are identified on the FEM and their eigenvalues extracted and used by HyperSizer Composites. Frequency FEA solutions are also used in the optimizations.

Analysis Methods

Many different failure criteria are provided and can be selected by the user. Ply based failures include max strain, max stress, quadratic methods like Tsai Hahn, and physically based methods such as Hashin and Puck 2D and 3D. Laminate based aerospace damage tolerant criteria are also provided such as Open Hole Compression (OHC), Compression after Impact (CAI), and Barely Visible Impact Damage (BVID).

Material Allowables

The complete offering of strength failure criteria though is only part of the story. Just as important are the associated material allowables and correction factors. The user can create materials and be able to fully define allowables according to their OEM and Tier 1 approaches.

Design Criteria

You can select laminate design criteria such as symmetric and balanced layups, as well as fabrication techniques such as full body plies across the part surface. These are the first sets of plies placed in the tool.