

## Review of Laminate Modeling Examples

Modeling Example	What We Discussed	Remarks
1. 2D laminate model	<ul style="list-style-type: none"> <li>Defining a 2D orthotropic material, layup, laminate property card (PCOMP), and material angles</li> <li>Symmetric vs. unsymmetric layups</li> <li>NOFISR, SRCOMPS parameters in analysis set manager</li> </ul>	<ul style="list-style-type: none"> <li>Based on Classical Lamination Theory</li> <li>Does not account for out-of-plane stresses or interlaminar stresses</li> <li>Uses an approximation technique to calculate the out-of-plane shear stresses (generally not calculated unless there are out-of-plane deformations)</li> <li>Not recommended if interlaminar stresses are significant (e.g., when you have free edges or holes)</li> <li>Easy to model and computationally less expensive</li> </ul>
2. 3D laminate model	<ul style="list-style-type: none"> <li>Defining a 3D orthotropic material, layup, solid laminate property card (PCOMPS), and ply/stack direction</li> </ul>	<ul style="list-style-type: none"> <li>Accounts for out-of-plane stresses or interlaminar stresses</li> <li>Recommended if interlaminar stresses are significant (e.g., when you have free edges or holes)</li> <li>Computationally more expensive</li> </ul>
3. 3D sandwich composite model	<ul style="list-style-type: none"> <li>Defining facesheet and core materials, separate layup definition for top and bottom facesheets, and separate laminate property cards for each facesheet and core.</li> <li>Additional methods for modeling a sandwich composite</li> </ul>	<ul style="list-style-type: none"> <li>3D modeling is recommended if interlaminar stresses are significant</li> </ul>
4. 2D laminate failure model	<ul style="list-style-type: none"> <li>Selecting a failure criterion and defining required material properties</li> <li>Reviewing failure indices and creating an envelope for selected output vectors</li> </ul>	<ul style="list-style-type: none"> <li>Can use the API functionality and develop custom failure models (e.g., onset theory)</li> </ul>