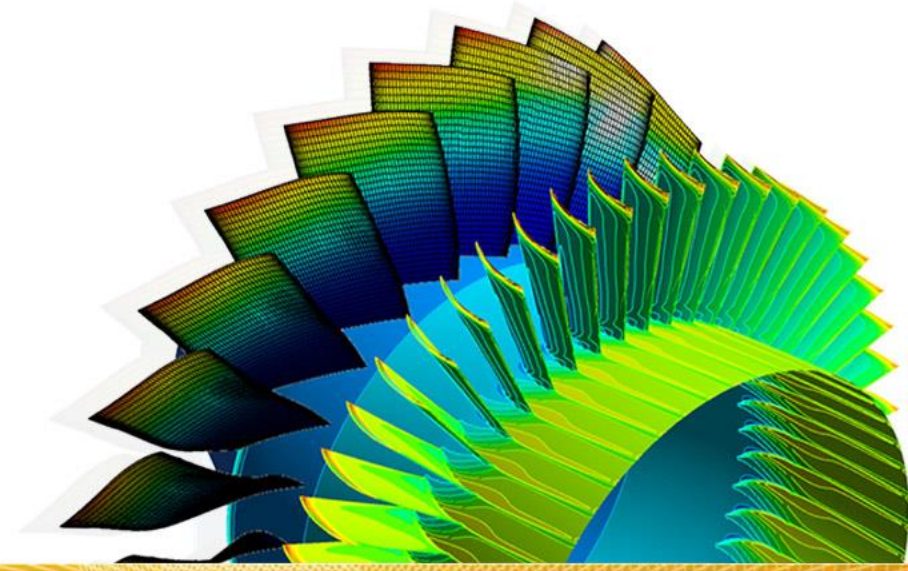
ANSYS Composite PrepPost 19.0

Module 10: Progressive Failure and Crack Growth Analysis

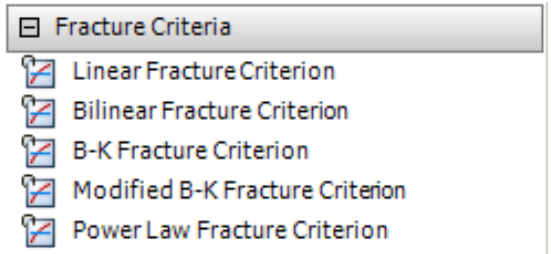


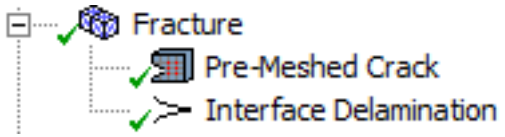
10. Delamination and Crack Growth

- Two different approaches are available for interface delamination

1. based on ***fracture criteria and fracture mechanics*** (VCCT-Based Crack Growth Simulation)

   Crack is initiated by an failure criteria and is developing along predefined path. **Can be defined in ACP using interface layer**

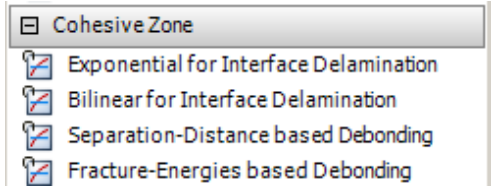


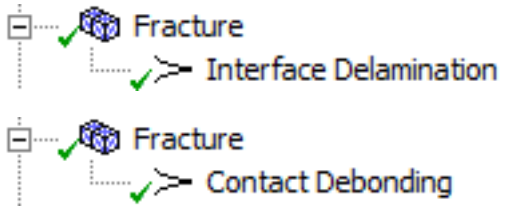


2. based on ***hardening-softening material laws*** (Cohesive Zone Materials)

   1) used with Interface Elements (Interface Delamination) **Can be defined in ACP using interface layer**

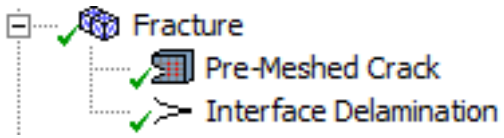
   2) used with Contact Elements (Contact Debonding)





10. Delamination and Crack Growth

- **First approach: VCCT-Based Crack Growth Simulation**
- Different Failure Criteria f (if f ≥ 1 failure occurs) are available
  - by direct input of the critical Energy-Release Rate



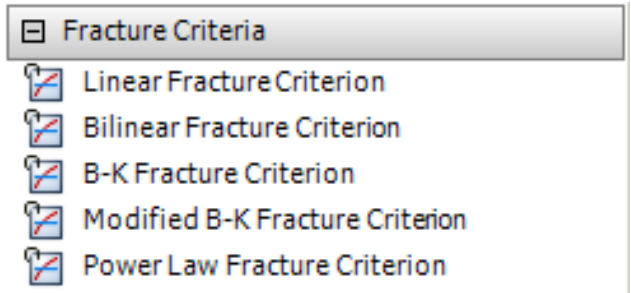
Details of "Interface Delamination"

Definition	
Type	Interface Delamination
Method	VCCT
Failure Criteria Option	Energy-Release Rate
Critical Rate	0,27183 mJ/mm²
Suppressed	No

  - by specifying a Fracture Criterion coming from the Engineering Data Page
  - different Fracture Criteria are available

Details of "Interface Delamination"

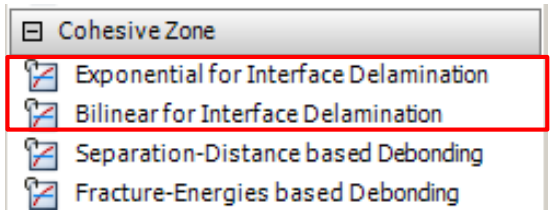
Definition	
Type	Interface Delamination
Method	VCCT
Failure Criteria Option	Material Data Table
Material	Linear Fracture Criterion
Suppressed	No

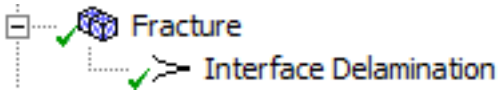


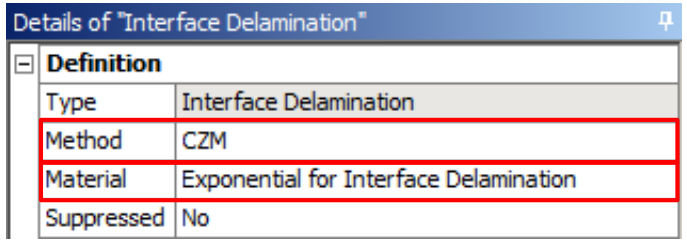
  - Crack is initiated by failure criteria and is developing along a path made up from interface elements

10. Delamination and Crack Growth

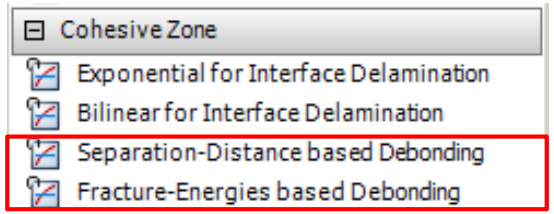
- **Second approach: Cohesive Zone Material**
- Different Cohesive Zone Materials are available
  - for an interface modeling with Interface Elements (specify the CZM method, Interface Delamination)

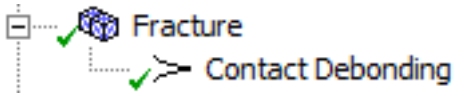


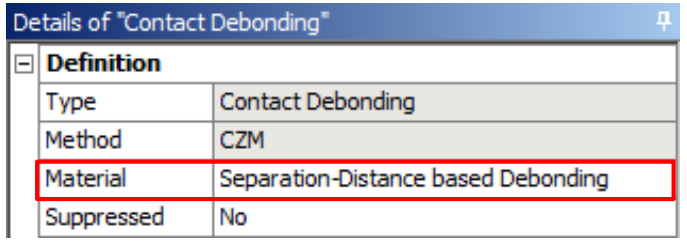




  - for an interface modeling with Contact Elements







- The crack growths according to the defined material behavior

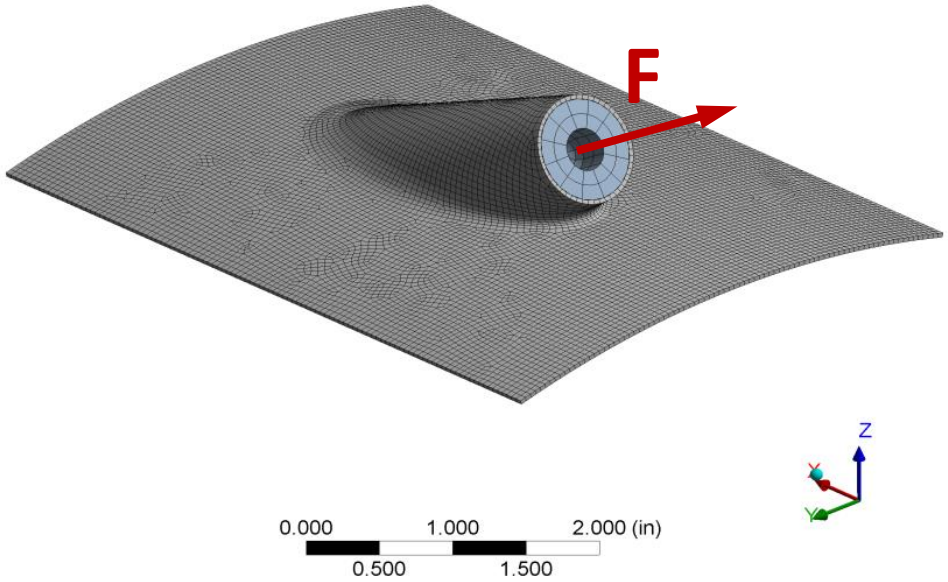
10. Delamination and Crack Growth

Progressive Damage

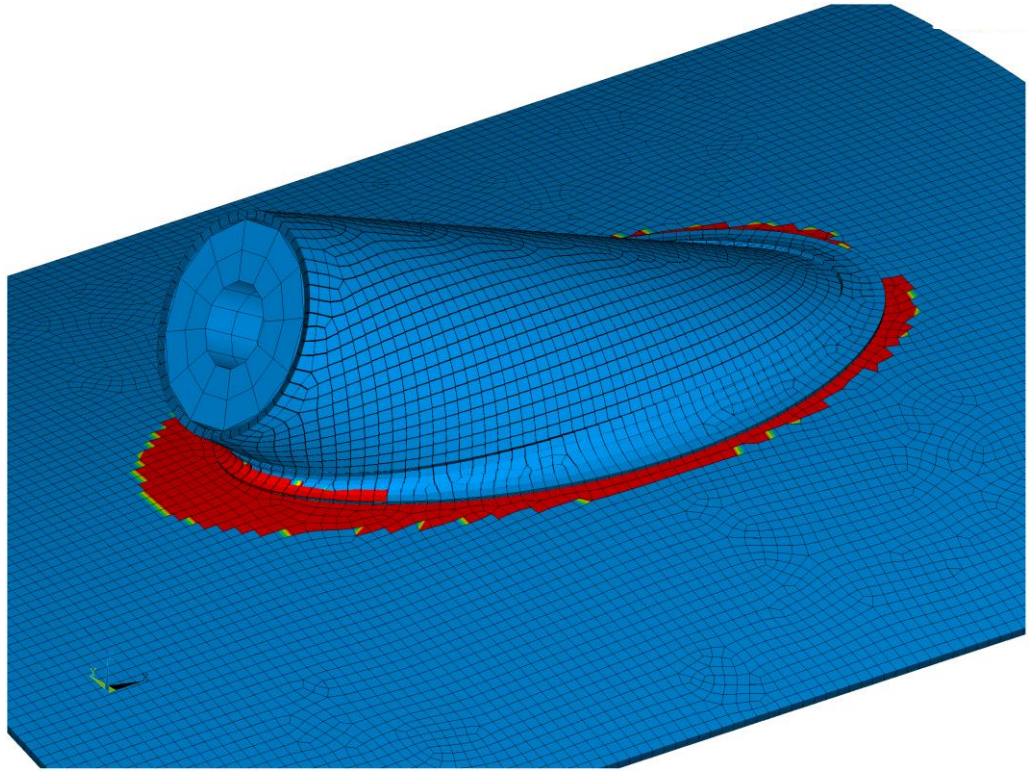
- Analyzing the progressive damage of composite design is possible in ANSYS using additional material properties introduced into Engineering Data
- The user needs to define the failure criteria used for the compressive fiber and matrix failure as well as for tensile fiber and matrix failure.
- Maximum Stress, Maximum Strain, Puck, Hashin, LaRC03 and LaRC 04 are available
- The user can define the stiffness reduction for all four failure modes

10. Delamination and Crack Growth

Progressive Damage



Model and Load



Damage Status

10. Delamination and Crack Growth

For more information check Workshop 16 – Modeling Progressive Damage – Advanced Example