

MULTI-SCALE MODELING OF DAMAGE AND DELAMINATIONS FAILURE IN CERAMIC MATRIX COMPOSITES

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Ceramic Matrix Composite (CMC) materials are high-temperature material of particular interest to aircraft engine manufacturers as they have the potential to provide better thermal efficiency at a lower weight compared to conventional metallic materials. As these materials are being inserted into service it is essential to understand their damage and failure mechanisms to ensure designs with sufficient margins as well as their long-term durability. High-fidelity analytical and computational models of CMC failure processes can enable robust design of CMC components. This talk will focus on multi-scale modeling of elastic behavior as well as ply-damage and delamination fracture in CMCs developed over many years under several AFRL funded programs. The effects of defects as well as issues in scaling the behavior from coupon-scale to component-scale will be discussed via analysis of test coupons and representative sub-elements.