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This presentation will introduce the newly formed research group CraCS (Cracs in Composite Structures) at AAU and outline a new integral formulation for the analysis of delamination growth in layered composite structures, which the CraCS group developed in joint collaboration with the AMADE group from the University of Girona, Spain. A new computational method for simulating fatigue-driven delamination applicable to large and arbitrarily shaped fracture process zones is presented. The model uses an envelope load approach and avoids making use of any fitting parameters in the link between the damage rate and the crack growth rate. Thus, all the model input parameters are determined experimentally from coupon tests. Any variant of the Paris' law relying on the mode-decomposed energy release rates can be used to describe the crack growth rate. To compute the mode-decomposed energy release rates, the model incorporates a new formulation for evaluating the J-integral. The concept of the growth driving direction is introduced to render the integration paths across the cohesive zone and to decompose the J-integral into mode I, II, and III. The proposed method leads to accurate prediction of delamination propagation under mixed-mode and non-self-similar growth conditions. Finally, the model is validated against a new experimental benchmark case with varying crack growth rate and shape of the fracture process zone. The test configuration is based on wide double cantilever beam specimen with two reinforcements bonded on both faces of the specimen in order to promote a curved delamination that changes shape and crack growth rate during propagation. The delamination front is monitored with X-ray radiography, and the obtained results are compared to the numerical predictions producing excellent agreement.