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ABSTRACT

The subject of the present thesis is the fatigue behaviour of multi-layered glass-fiber reinforced composite tubes and of unidirectional reinforced laminae. By varying the fiber direchtion of the multi-layered tubes the fundamental damage mechanisms with special attention to alternating torsional loading has been studied. The damage has been described quantitatively and also qualitatively by means of damping.

The concepts of the continuum mechanics theory which are well-known in the case of static loading, are shown to apply also to the above mentioned alternatingly loaded, angle-plied composites. By means of step-by-step linearisation it was possible to consider the nonlinear in-plane shear behaviour and to take into account partial damage, in order to calculate strenth and stiffness. That means that the limits of the theory of continuum mechanics are extendable to such applications.

This "extended theory" should also be applicable to other composites and to other load cases besides the ones considered in this work. However, it is not applicable to describe fatigue behaviour when the influence of nonlinear shear is too big, or when there are too many matrix-cracks, or when there is stability failure of the outer compression layer due to too many delaminated zones.