SM4S_12277

XXI International Congress of Theoretical and Applied Mechanics
Warsaw, Poland, August 15–21, 2004

Computational Micro–Meso Modeling for Laminates Under Thermomechanical Fatigue and an Oxidizing Atmosphere

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One computational approach for studying damage in laminated composites is the damage mesomodel for laminates, which has been developed for more than fifteen years, particularly at LMT-Cachan. Recently, we introduced micro-meso relations which prove that this mesomodel is compatible with classical micromechanical analysis and, therefore, can be viewed as a homogenization of classical theories on the microscale. Consequently, basic material quantities on the microscale can be easily interpreted on the mesoscale. Here, we propose to use these micro-meso relations as a tool for studying the degradation of laminates under fatigue in an oxidizing atmosphere. The reason why we are interested in this specific topic is that carbon-epoxy laminated composites are candidate materials for the construction of the future European civil supersonic aircraft. Our approach is rather simple: first, the influence of fatigue or oxidation on basic material characteristics is studied on the microscale; then, the equivalent damage evolution law on the mesoscale is obtained thanks to the micro-meso relations.

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