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PREDICTION OF POLYMERIC COMPOSITES MATERIALS' RESIDUAL STRENGTH AFTER DAMAGE DUE TO DIFFERENT DAMAGE SOURCES

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ABSTRACT

All structural components when under working conditions, are subjected to damages resulting to respective deterioration of their mechanical response. The type and the extent of damage depend not only on the materials' structure, but also on the working and general environmental conditions. The main causes, for damage development in polymeric materials, are: water absorption (or moisture) from the environment, random simple impact, repeated impact, mechanical, thermal or hydrothermal fatigue and any combination of the above-mentioned damage sources. As a result, damage deteriorates polymeric materials' response and occasionally their fracture behavior. In the present investigation, several factors responsible for damage development in polymeric composite materials as well as their consequences on the mechanical degradation will be studied. In addition, prediction of the said degradation due to damage is presented and predicted by simply applying the RPM model (Residual Property Model). As it will be shown the Model predicts the material's behavior after damage independently of the source which creates the damage. The RPM model has already been successfully applied in a series of experiments in order to compare predicted values with experimental findings. For the application of the Model only one experimental point is needed to predict the whole variation of the mechanical properties of polymeric materials as a function of the extent of damage and/or respective energy independently of the damage source. Thus, the model works almost as an NDT method due to the very limited number of input data needed for its application. The prediction is valid up to a limit above which linearity does not apply anymore.