4.2.9. APPLICATION OF THE BRAGG GRATING OPTICAL SENSORS AND EDDY CURRENT METHOD FOR THE NON DESTRUCTIVE TESTING OF BONDED COMPOSITE REPAIRS

Tsamasphyros G., Kanderakis G., National Technical University of Athens, Athens, Greece;
Vouthounis P., Technological Educational Inst., Dept of Civil Works Technology, Egaleo-Athens, Greece;
Prassianakis I., National Technical University of Athens, Athens, Greece

The repair technology of cracked metallic structures has benefited due to the increasing demand for life extension of both military and civil aircrafts leading to significant advances in repair technology of damaged metallic structures, thus, proving bonded composite repairs of metallic structures a rapidly growing technology in the field of aerospace. Given the specific characteristics of a bonded composite repair and the differences in the materials used in each case (metal, composite & adhesive), the applicability of a number of Non Destructive Testing (NDT) methods to trace crack propagation under a composite patch repair is investigated, following fatigue testing. For this scientific venture, the main NDT methods examined include Bragg grating optical sensors (embedded into composite patches) as well as the eddy current method applied over a bonded composite repair (i.e. avoiding repair disassembly). Bragg grating sensors were proven capable of tracing crack propagation with high accuracy, through interpretation of the differences caused in the strain field over the crack, after comparison with finite element analysis results. On the other hand, the capability and the reliability of the eddy-current method to detect cracks under a composite obstacle of significant thickness were checked over a range of patch thicknesses. The eddy-current method was found to be fully capable of tracing the crack propagation under the composite patch, requiring only proper calibration of the generator. Minute differences in crack lengths between the patched and the unrepaired side of the specimen examined were due to their non-symmetric configuration, which induced different stress intensity factors at the patched and the unrepaired sides, as finite element analysis has shown.