NUMERICAL SIMULATION ANALYSIS OF THE SENSING CAPABILITIES FOR EMBEDDED METALLIC GRID, APPLIED TO COMPOSITE PATCH REPAIR

G.J.Tsamasphyros, G.Kanderakis, A.Christopoulos

The National Technical University of Athens,
Faculty of Applied Sciences, Dept. of Mechanics-Lab of Strength Materials, Zografou Campus,
Theocaris Bld.,GR-015773, Athens, Greece

ABSTRACT

Keywords : Composite Patch Repair, Structural Health Monitoring, Induction Heating

The development of fibers and adhesive systems (cohesive) with high durability, led the last years to the creation of a new repair method of metallic structures by the use of reinforcing patches from composite materials. This technique is reported in the international bibliography as "Composite patch repair" and provides very important advantages compared to the conventional methods of repairs. On the other hand the technology of induction heating constitutes an innovative approach to achieve supply of energy for the curing of resins or for the manufacturing of composite materials. Induction heating, takes place in the ferromagnetic materials, when these are submitted in periodically varying magnetic field. As a result Eddy Currents are induced in the material, producing heat (Joule phenomenon). In the case of curing resins, a ferromagnetic material must be imported inside, to produce the required heat. This may be achieved by importing a metallic grid in the resin. Moreover this metallic grid which remains inside the resin after the curing may serve as sensor by analyzing it's electrostatic properties, thus providing useful information about the structural integrity of the area (potential increase of the crack below a bonded composite repair). Every change in grid's total resistance is translated as deformation. As it was proved via numerical simulations, by the use of a Neural Network it is possible to calculate plate's crack length and the size of the deforming load, with exceptional precision, receiving only four measurements of intensity I of electric current .