

Abstract ID-137

INTEGRATED LIFE CYCLE MANAGEMENT OF AGEING STEEL INFRASTRUCTURE BASED ON SMART TECHNOLOGIES

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Keywords: Structural Health Monitoring, Steel, Structures, Electromagnetism, Micro Aerial Vehicles

Summary: The increasing age of infrastructure such as bridges or tall buildings requires a significant effort to be performed with respect to inspection such that damage being considered critical can be recognized early in advance and a respective infrastructure management can be performed. Such an inspection today may require a remarkable effort such as specific, very costly and unique inspection vehicles to be used which will lift inspectors for mainly visual inspection to the infrastructure's locations of damage criticality and hence of interest. The paper to be presented will describe on how such an infrastructure can be inspected in a much more efficient way using micro aerial vehicles (MAV) together with different non-destructive techniques to be implemented into the structure. The MAV is first equipped with a high resolution camera that monitors the infrastructure visually, allows for damage critical locations to be observed and a 3D image of the infrastructure to be obtained, avoiding inspectors to be moved around the infrastructure under partially very critical operational conditions. From the 3D image obtained a digital model of the infrastructure can be constructed, that allows a simulation of the infrastructure's loading and resulting damage accumulation to be performed at least from a numerical point of view. The damage accumulation simulation obtained as a damage distribution map is then validated by some electromagnetics based non-destructive testing techniques. Data obtained with those techniques is therefore fed back into the simulation system allowing a full map of the infrastructure's damage condition to be retrieved and the most damage critical locations of the infrastructure to be identified although no damage may be observed visually. The approach made will be explained along an old steel bridge having been inspected and how this approach can be used in enhancing an old infrastructure's life cycle management process in terms of structural health monitoring.