Incorporation of a Smart Fiber Network within a 3D Fiber Textile Composite Near-net Preform Structural Member for Remote Structural Monitoring

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3D fiber textile composites are a type of fiber architecture that allows for the inclusion of a variety of fiber types within a three-dimensional near-net preform network. The inclusion of monitoring "smart fibers" within the architecture of the woven material allows for the through-member permeation of a fibrous sensor material. Typical fiber materials used for stress and strain monitoring are optical glass fibers linked to a central processor. In this way it is possible to gather important information regarding the health of a structure during construction and during its lifetime from a remote location. The study proposes to evaluate fibers for inclusion within a 3D FTC structural member as well as propose various sensor network architectures most productive for the applications listed. The materials chosen need to conform to the stresses inherent in the pultrusion and weaving processes during the production of the standardized structural forms.

Building Management System
Development of a network-based expert system to record the state of federal engineering structures and to give a prognosis about the future requirements for maintenance including the necessary strategies. Development of modules such as material-based damage models, determination of times of intervention, catalogues of maintenance measures and strategies as well as object-based maintenance optimization.

Development of intelligent structures which – equipped with sensors and actuators, directed by an electronic control system – react on variable exterior stresses by modification of rigidity and/or length of individual constructive elements. Minimization of weight by active influence on the flow of forces respectively on the static and dynamic load bearing behavior.

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