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Topic of the Speech:
Numerical Modelling and Experimental Analysis of Light Weight Composite Structures with Fibrous Reinforcement

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Professor Rajesh Mishra works at the Czech University of Life Sciences Prague, Czech Republic. His research areas are nanomaterials and nano-textiles, textile structural composites, green composites, nanocomposites, biomechanical engineering of fibrous structures, thermo-mechanical characterization of materials etc.

He has about 165 publications in international journals and about 270 presentations in international conferences. His teaching and research activities include subjects based on nanotechnology, bio-materials, structural mechanics of fibrous structures in general and 3D woven structures in particular, textile quality characterization, engineering of textile structures, biomechanics of apparel textiles etc. He is responsible for internationals students education and research at the faculty of engineering. Till date he has successfully guided 5 PhD candidates leading to award of title. The graduates are highly placed in academia and industry around the world. At present a few more are continuing research in leading areas of technology. He has also developed educational and research cooperation with many organizations around the globe.

ABSTRACT SUBMISSION
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Numerical Modelling and Experimental Analysis of Light Weight Composite Structures with Fibrous Reinforcement

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ABSTRACT (NO MORE THAN 500 WORDS:)

Textile composite is a polymer composite which is defined as the combination of resin system with a textile fiber, yarn or fabric-based reinforcement system. Textile fabric reinforced composites may be flexible or quite rigid. Having a non-crimp 3D fabric as composite reinforcement is obviously beneficial, because significantly higher in-plane stiffness and strength can be achieved. Single-layer preform or a few layers of such preform combined with advanced, automatically controlled closed-mold resin infusion system, allows avoiding a lot of flaws and irregularities. Fabric structural parameters, design and preparation of preforms etc. influence the resin impregnation. There are various experimental, analytical, and computational methods for evaluating the mechanical properties of composite materials. The finite element method (FEM) is the one of the numerical methods that are more powerful in their application in real world problems and can be used to calculate elastic properties. The commercial software ANSYS (Canonsburg, Pennsylvania, United States) is very user friendly and easy to design the required model. The Rule of Mixtures, based on the mechanics of materials approach, is the most basic model available for prediction of the composite properties from the properties of the matrix material, the fiber material, and the fiber volume fraction. It does not take the fiber shape or the fiber distribution into account. The models assume perfect bonding between the matrix material and fiber material. The matrix material and fiber material are assumed to be orthotropic, and they can be simplified to the isotropic case. Finite element method can be used as a tool for its predictive capabilities to solve numerically and represent analytically the behavior of a physical system. This system is divided into elements linked together by nodes forming a mesh to which properties and relations of interactions are allocated. This method gives an approximate solution to a problem. Composite will be designed by using the dimensional, physical and mechanical properties. 3D model of a composite structure can be designed and analyzed using ANSYS software. Numerical modelling based on finite element method. FEM is used as a tool for its predictive capabilities to solve numerically and represent analytically the behavior of a physical system. This system is divided into elements linked together by nodes forming a mesh to which properties and relations of interactions are allocated. This method gives an approximate solution to a problem. 3D model of the composite is designed by using the dimensional, physical and mechanical properties and analyzed. Development of polymer based composite samples are carried out with state-of-art technics like Resin Transfer Moulding (RTM), Autoclave/Vacuum bagging process, etc. Analysis of fatigue failure using high magnification Scanning Electron Microscope (SEM), study the properties of materials as they change with temperature by thermomechanical analysis like Dynamic force thermomechanometry (DFT) and testing the resistance/endurance of the component when it is subjected to harsh atmospheric conditions, are carried out by weatherability test. The experimental/computational test results are collected and compared with the existing components for performance analysis.