Preface

The current economic and ecological context requires different industries towards the optimization of structures. One of the most striking examples is the soaring price of oil, which launched the major aircraft manufacturers Airbus and Boeing in a race to relief structures, to reduce their consumption. Therefore, the need of competitive products, both in terms of reliability, performance or operating cost, is pervasive and growing, aviation and elsewhere. Thus, work on the material parts by offering innovative solutions to reduce their weight and improve their performance (new materials, new processes, etc.) is essential and becomes more than ever a major industrial challenge. One way of increasing the selected aircraft is use of composite materials. Indeed, their high ratio mechanical / density properties and excellent resistance to environmental significantly improve the structural performance of the aircraft while generating a significant weight gain (20 to 30% weight of a structure). They were originally implemented in the design of secondary structures of aircraft, but improving their manufacturing processes and a better understanding of their mechanical properties and their degradation mechanisms are they now used for the manufacture of primary structures, such as the fuselage or the central box of an aircraft wing. If applications were rather the military origin, composites now particularly interested in civil aviation, the constraints are much stricter certification, which requires predictability of behavior and life of structures much finer Thus, at present, they account for over 50% of the mass of newer aircraft such as the Airbus A350, the Airbus A380 or the Boeing 787.

The potential of composite materials is important, but will speak only on one condition: work not only on the basic constituents of the material (fibers, resin, ...) on the injection preparation conditions (methods, thermal cycle, shaped in the mold, ...) but also and above all on the function of the material in the structure. Indeed, the material is a component of a more complex system, consisting of parts, assemblies, subassemblies and the structure itself. This vision system involves understanding the material as parameters, not data, an overall optimization of the structure. This link between material and structure is evident for composites where fiber orientation, or reinforcements in a more general way, in the direction of efforts can greatly increase the performance / weight ratio. We understand that optimizing the structure requires, among other things, a design material to locally respond to the "just need" structural.

The main objectives of this special issue (consisting mainly of a selection of papers presented at 5th International Symposium on AirCraft MAterials ACMA 2014) are, by means of modeling strategies and simulation out with conventional strategies, pushing the current limits in modeling and computation in response industrial and societal challenges. It is also to control the calculations and models in a framework that takes into account the major sources of uncertainty to optimize materials and structures. Particular attention is made to the modeling and validation of composite materials and structures.

Guest Editors: M. Karama, H. Borouchaki, A. Cherouat, A.EL Hami