# Computational mechanics: some methods and their applications

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**Abstract**

C*omputational mechanics* can be regarded as a sub-discipline of theoretical and applied mechanics concerned with the use of computational methods and devices to study events governed by the principles of mechanics. However, such can be seen as well as a sub-discipline of predictive computational science. In few words, this exciting field deals with the formulation, calibration, numerical solution, verification and validation of mathematical models targeting at predicting the behavior of mechanical systems. In addition, this can also be associated to the presence of uncertainties. Regardless of its many flavors or associated perspectives, computational mechanics has been proven to be a fundamental tool in many dissimilar fields.

In this plenary lecture, I will present some of the work that I carried out in the last decade and a half within the field of computational mechanics, specifically rigid and flexible solids as well as fluid-structure interaction. The first part is concerned to numerical methods, which within that scope are designed to preserve some invariance laws that are essential to produce meaningful physical pictures. The second part deals with the systematic application of these numerical methods to approximately investigate the mechanical behavior of systems that are relevant in engineering, ranging, for instance, from bio-inspired micro-swimmers to wind turbines.