Editorial

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Our journal is devoted both to solid and fluid mechanics and, therefore, in all issues it is possible to see links between the different areas of mechanics. The common denominator is the mechanics of the continuum. The history of continuum mechanics is traced from the early work of the Hellenic period up to the present century. This history is based upon early work in statics, deformable solids, dynamics, fluid mechanics and aerodynamics. The unifying theory of continuum mechanics came in the 1900s combined with the advances in thermodynamics and rheology.

It is believed that one of the precursors of the continuum mechanics and studies of the interactions between solids and fluids was Leonardo da Vinci (1452–1519), whose 500th anniversary of his death is celebrated this year.

Leonardo da Vinci (1452–1519) noted that ‘Mechanics is the paradise of Mathematical science because here we come to the fruits of mathematics.’ As shown by Kemp (2019), Leonardo da Vinci was a man ahead of his time. However, in crucial respects he was very much a man of his time. His versatility was foreshadowed by the great artist-engineers of the Italian Renaissance. Notably, Filippo Brunelleschi, inventor and architect of the massive dome of Florence Cathedral, formulated the science of linear perspective for painters in the early years of the fifteenth century. In his work on physical sciences, Leonardo was heir to medieval theories of statics and dynamics. Kemp (2019) observes that Isaac Newton was still far away. Leonardo’s anatomical researches merged medieval physiology with the functional and morphological analyses of the classical physician Galen.

Codex Leicester (Leonardo da Vinci, 1510) contains the first-ever detailed description of the movement of waves and the effects of their impact on seashores and riverbanks. Leonardo interprets wave movements in terms of weight, impetus and

percussion. He analyses the impact of a wave on the shore in exceptional detail, showing that the backward ridges of its crest collide with the next wave — for example see Codex Leicester, f. 26v.

Continuing this ancient tradition of studies on the continuum mechanics, the main topics of the present issue of our journal are static and dynamics of structures and wave mechanics.

Pending further developments, research in the field of structural engineering must continue also improving classic materials. In fact, one of the papers of this issue, Kostova *et al.*, (2019) observe that there are no reasons why concrete elements should be prismatic. Concrete is mouldable and can be cast in efficient forms which follow the stresses varying along the length of a concrete element. Fabric deforms under the hydrostatic pressure exerted by wet concrete during construction, creating the shape of hardened concrete. The final shape needs to be known in advance to be able to perform the analysis and design of structural elements. This paper presents a form-finding approach capable of predicting the shape in cross-section of flexibly formed concrete elements.

There is always room for classic structures, which are always interesting and important, as shown for a classic linear structure, which is analysed in the second paper of this issue (Mahmoudi *et al.*, 2019) in terms of dynamic responses evaluated and controlled by the Sliding Mode Control (SMC) algorithm. The authors show that robustness of the SMC-based algorithm against disturbances has made it possible to implement the method in civil structures under unknown vibrations. The results show the reasonable performance of the SMC method in dissipating the responses as satisfactorily as the linear quadratic regulator method. Consequently, the authors observe that the SMC is an effective method for reducing vibrations.

The third paper of this issue (Baines *et al.*, 2019) is devoted to the use of the numerical modelling approach of Smoothed Particle Hydrodynamics (SPH) to simulate a violent wave breaking at seawalls, in order to analyse landward pressure fields. To date quantification of these pressure fields is little understood and the paper presents a comparison between experimental and numerical results. The increasing interest on the wave mechanics topic is demonstrated by many international projects, such as the European research project ‘SPANWAVE-SPPORITA’ carried out at the ‘Canal de Investigación y Experimentación Marítima’ of the Polytechnic University of Catalonia, Barcelona, Spain (Sancho *et al.*, 2001). The SPH numerical code, used by the authors, was introduced by Gingold and Monaghan (1977), and Lucy (1977). It has been efficiently used for many kinds of waves, such as shockwaves (Ben Meftah *et al.*, 2007 and De Padova *et al.*, 2013), interactions between structures and waves (De Padova *et al.*, 2016), coherent structures and vorticity in many complex fluid flows (De Padova *et al.*, 2018) and in many other fields. It is curious to observe that the SPH code was developed to study non-axisymmetric phenomena in astrophysics in the 1970s but its application to engineering emerged in hydrodynamics applications (Monaghan, 1994), structural mechanics (Libersky and Petschek, 1991) and other engineering applications. In the past twenty years the methodology has developed in many fields of application, since, as a purely Lagrangian technique, SPH enables the simulation of highly distorting fluids and solids.

This issue highlights the propensity of our journal to publish multidisciplinary research results, both in solid and fluid Mechanics, which is surely one of the reasons of its increasing success. I hope that also the present papers will be appreciated by our readers.

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