Editorial **Open Access**

Antonio F. Miguel , Luiz A. O. Rocha, and Andreas Öchsner

Preface to the Special Issue on Engineering Flow and Design

DOI 10.1515/eng-2015-0029

The importance of design in natural and engineered flow systems is undisputed. It is not only essential to life, but also plays a crucial role in our technological world. In Nature, it arises organically, spontaneously, and is the constructal path for systems to persist in time. The generation of the best design is the target of engineered flow systems. Fluid dynamics and thermodynamics have played a crucial role in the search for these flow designs. Analytical, numerical (CFD) and experimental studies played crucial roles in many technological breakthroughs. They provide the frameworks for understanding, simulating and interpreting flow phenomena.

This issue contains a selection of papers presented at the special session "Fluid Flow, Energy Transfer and Design" held at the 10th International Conference on Diffusion in Solids and Liquids in Paris, June 2014.

The first paper of this issue is focused on vascularization. In vascular design, flow bathes the containing volume almost uniformly, and is widely encountered in natural systems (river basins, lungs, etc.). Smart materials with advanced capabilities such as self-healing and self-cooling require bathing the entire volume with a healing agent or coolant fluid. Constructal theory focuses its attention on the relationship between the architecture of the flow system and its global performance, and Erdal Cetkin explores new constructal vascular designs for self-healing and self-cooling while decreasing the resistances to flow.

Cement-based materials are envisaged in both surface and deep geological nuclear waste repositories. The success of this confinement and storage lays on precise estimations of physical and chemical properties, such as the diffusivity. Hugo Mercado-Mendoza and Sylivie Lorente review the progress made by INSA in developing a technique based on "Electrochemical Impedance Spectroscopy" to determine the diffusion coefficient through non saturated porous materials.

The ocean is an inexhaustible source of energy. Wave energy is a promising but also a challenging form of renewable energy to harvest. Mateus Gomes and co-authors compare two types of physical constraints in the chimney of an oscillating water column device.

Nanofluids are solid suspensions of nanometer-size particles in a base liquid and find important applications in several areas including biomedicine, automobile, microelectronics, nuclear systems and power generation. These fluids are characterized by higher thermal conductivity and single-phase heat transfer coefficients than their base fluids. Mixed convection of Cu-water and Ag-water nanofluids in a square cavity is studied by Abdelkader Boutra and co-authors. The interest on soot formation stems mostly from environmental concerns on pollutant emission from combustion devices. Soot also contributes to thermal radiation loads on combustor liners and turbine blades. In the final paper of this issue, Nattan Caetano and co-authors investigate the soot formation in a flat flame burner using premixed compressed natural gas and air.

The collection of the articles in this issue, along with a complementary and expansive volume devoted to the same subject[1], reflect and reaffirm the importance and relevance of the study of flow design in natural and man-made flow systems in the twenty-first century.

We would like to thank the authors for their efforts in preparing the special issue articles. We are indebted to the anonymous reviewers who participated in the editorial process. Thanks are also due to Dr. Marek Domanski, Managing Editor of Open Engineering for your invaluable help and guidance throughout.

Antonio F. Miguel : University of Évora, Portugal
Luiz A. O. Rocha: Federal University of Rio Grande do Sul, Brazil
Andreas Öchsner: Griffith University, Australia

1 A. F. Miguel, L. A. O Rocha, A. Öchsner (editors) Fluid Flow, Energy Transfer and Design II, Defect and Diffusion Forum 362, Trans. Tech. Publications, Switzerland, 2015