

## EDITORIAL

To start a new journal in a fast growing scientific panorama is a serious challenge. We decided to start this new adventure because we felt the necessity of having an applied math journal covering an area of great interest and experiencing a big expansion.

**Background.** Extensive searches in mathematical databases on published papers about Networks and Heterogeneous Media 2000-present, showed something close to 450 papers/yr about networks, 50/yr about multiscale problems, 100/yr about porous media and 25/yr about heterogeneous media. This is a serious motivation to launch a new journal focused on Networks and Heterogeneous Media. There are three main features of this journal:

- i) Interdisciplinary Character;
- ii) Specific Focus;
- iii) Mathematical Core (Deep Mathematical Content).

Clearly there are a number of existing journals sharing some of these features. However, this new journal will offer a unique strong combination of i)–iii).

This journal also aims at creating a link between the discrete and the continuous communities, which distinguishes it from other journals with strong PDE orientation.

It is expected that research on Networks and Heterogeneous Media, motivated by a wide range of applications (such as traffic flows, internet network, bio-medical problems, filtration, granular flow etc...), will be one of the most challenging direction in future mathematical research and will result in the development of new fundamental mathematics.

**Technical Motivations for NHM.** While the classical modeling and analysis approach is efficient for systems evolving on Euclidean spaces or manifolds, many recent applications require the development of mathematical tools for state spaces with a more complicated structure, such as a fractal, a stratified set or a topological graph or, in the case of many interacting evolutions, for a collection of different state spaces. These special structures arise naturally in a number of applied problems ranging from mechanical ones like the static and dynamics of granular media to biological ones like vessels pattern formation in angiogenesis.

Such problems can be studied by developing an analysis directly on the complicated media or via limiting procedures on the microstructure to obtain auxiliary systems on classical spaces, with the appearance of new terms in classical equations and/or enlarged state spaces. This situation is typical of discrete networks, which can be used to approximate hard problems on continua, or can be studied by continuum limits. Also, an example of limiting procedures is given by homogenization limits for various materials with several constituents.

Other important examples include continuum networks, i.e. one dimensional complexes, which are the natural space for car traffic or telecommunication data

flow. The determination of the natural dynamics or the typical stochastic behavior at vertices requires an investigation of flows in networks. The presence of different time or space scales may give rise to similar phenomena requiring singular perturbation methods, mean fields analysis and other limiting procedures.

**Aims & Scope.** The proposed journal aims at attracting original contributions of highest quality in Networks, Heterogeneous Media and related fields. Currently the research in this area is scattered across a wide range of statistical physics, applied mathematics, engineering, socio-economical and bio-medical journals. Networks and Heterogeneous Media will bring together all these different research lines by emphasizing the common underlying mathematics.

NHM is thus devoted to the presentation of research work on complex media arising in mathematical, physical, engineering, socio-economical and bio-medical problems such as: atomistic to continuum approach to elastic solids, vehicles traffic flow on networks, social networks, telecommunication networks and internet, homogenization of complex media, random media, mass transfer and its interaction with hydrodynamic descriptions of flows, macroscopic evolutions in complex and random media, multiphase flows in porous media, biological flows, mechanical and biological properties of tissues, currents in micronic and submicronic electronic devices, conservation laws models in complicated media, kinetic description of hydrodynamic flows, multiscale phenomena, etc. etc.

The emphasis of the journal Networks and Heterogeneous Media is on modeling, analysis, control, numerics and applications. Occasionally, invited state of the art reviews will be published when they provide a solid background for future research.

**The Editorial Board.** The Editorial Board has a high dynamic profile: a mixture of research leaders of the area in all stages of academia, from young rising stars to senior well established researchers with a broad scope of scientific interests. They represent a wide variety of different fields, with a special emphasis on analysis and modeling skills.

All members demonstrated excellent quality of their scientific work, which is characterized by a combination of deep mathematics and a high impact in applications.

This first issue is a perfect example of our conducting spirit, containing interesting contributions in a wide range of application domains from internet to biological systems, from gas flow to nonlinear elasticity and so on.

It remains to wish you a nice and fruitful reading,

Benedetto Piccoli  
Editor in Chief