PIERRE SEPPECHER

Pierre Seppecher is currently Professor at the University of Toulon (France). He is a "Normalien": in 1978 he is admitted, after a strict selection process, to the "Ecole Normale Supérieure de Cachan" (ENS Cachan) and he attends the courses at University Paris XI to obtain his "Maîtrise" (Master of Science) in Mathematics.

The vocation of the ENS Cachan is to train scientists with a deep understanding of the basic theoretical knowledge and with a particular ability in using this knowledge to conceive important models for applied sciences.

Pierre Seppecher has a very strong and determined personality: when he became "Maître de Conferences" at the University Pierre et Marie Curie (Paris VI), he decided to move to the University of Toulon-Var in order to contribute to the foundation of the Institute of Mathematics, where he has been responsible for financial-accounting management since 1998. His background allowed him to assist in the foundation and direction of this new university institution with the highest competence and effectiveness.

He always conducted his own research and directed the research activities of his young collaborators following his innate curiosity and exceptional creativity which never accepted prefixed cultural limits. His challenging administrative and managerial activity did not prevent him from becoming a member of the French National Committee for the Mechanical Sciences (a French organism which grants the license permitting the function of university professor, necessary to participate in local / public exams for fixed university positions and to obtain promotions), a member of the Committee for the Scientific Research in his university and also an expert of the French National Agency for Evaluation of Research and Higher Education (AERES), recently founded in France. Not even these intense management and directional activities impeded him in the production of scientific publications, the originality of which can be undoubtedly judged as excellent.

We can affirm that Pierre Seppecher represents a rare example of scientist who is able to show exceptional competences in different domains, i.e. in pure mathematics, applied mathematics, mechanics, thermodynamics, electromagnetism and numerical calculus.

He is a scientist who uses his multidisciplinary knowledge to attain the creativity necessary to obtain very original and high-impact results.

In his PhD thesis Pierre Seppecher begins to study some phenomena of capillarity in fluids. His works in this field show his capacities as a complete and eclectic researcher: he deduces the equilibrium equations for drops which are suspended or in contact with a wall, proving the theoretical necessity of introducing new physical and mathematical concepts to describe these phenomena. Subsequently, he proves elegant theorems of existence and uniqueness for the equations that he formulated. Finally, when he could use one of the first supercomputers from Toulon, physically situated in the city of Marseille, he created software which was able to solve his equations and hence to describe phenomena of line tension which are very important, for instance, in the lubrication of mechanisms.

This is the level of Pierre Seppecher's works and the peculiarity of his scientific character which can be, with no doubt, defined "Archimedean": he is an elegant mathematician who does not disdain to be involved in the development of design methods which can be applied in practical technology.

His eclecticism is also proved by the variety of lectures which he has given through the years: courses preparing for public exams for schools of engineering, lectures on numerical calculus, rational mechanics, continuum mechanics for engineering, calculus for schools of mathematics, advanced courses on theory of capillarity, differential geometry, optimization theory, relaxation methods and problems of singular perturbations, topology and measure theory.

Pierre Seppecher is not just a specialist of a specific theory. He, instead, decides to investigate a certain class of phenomena, he develops the best model suitable to their prediction, he frames the problems in a mathematical context in order to show the efficacy of the proposed model, he proves the corresponding theorems, he solves numerically the proposed equations and he is able to give precise indications to rationally "design" the real systems which he describes.

Considering his works, which have been published in International journals of great prestige, we remember the following remarkable results

- The proof of the generalized version of the Theorem of the Tetrahedron of Cauchy, applied to second gradient continuous media.

- The characterization of the relation between the Laplace's model for surface tension and second gradient theories.

- The characterization of trusses with deformation energy depending on higher gradients of the displacement field.

- Relaxation theorems valid when the deformation energy concentrates in small structures and the definition of the vector space tangent to a measure.

- The study of singular perturbation problems for degenerate variational systems with applications to the study of clouds of droplets or to problems of image reconstruction.

- The study of homogenization problems in the theory of non-linear elasticity with applications to the theory of beams in large deformation.

- Homogenization theorems for Maxwell's equations and for mechanical and electrical systems when the frequency is fixed.

- The formulation of the jump and propagation conditions for shock waves in porous media.

As for his contributions to pure mathematics, we observe:

- The first proof of the fact that second gradient continua can be obtained as the homogenized limit of first gradient continua.

- The proof of the fact that the roughness of a solid-fluid interface determines its properties of wettability.

- For the first time the rigorous proof of the fact that a Cahn-Hilliard model can produce a model of capillarity with line tension. These studies have underlined the fact that the model of line tension usually used is illposed and that only the introduction of surface phases allows the correct description of phenomena of tensions which are concentrated on lines. These surface phases separated by transition lines coincide with the socalled wetting-films which have been observed experimentally. In the works of Pierre Seppecher these transition lines are clearly distinguished from the contact lines, even if in many cases these two lines can occupy the same place .

- The determination of the Gamma-closure of the set of functionals of diffusion and of the set of functionals of linear elasticity without restrictions on the coefficients. In this way one can characterize all the materials which can be obtained by homogenization of inhomogeneous materials with strong variations of material properties.

For all reported reasons the committee,

entrusted by the
“FondazioneLevi-Civita”

with the responsibility of awarding the
International Levi-Civita Prize

unanimously propose Professor Pierre Seppecher as the winner of the
2010 edition