Jean-François Ganghoffer is currently a Professor at University of Lorraine, member of LEM3 - Laboratoire d'Etude des Microstructures et de Mécanique and of the ENSEM - Engineer School in Mechanics and Electricity. He received his PhD degree from Ecole des Mines (Nancy, France) in 1992, after a joined international collaboration (PICS) with the department of Mechanical Engineering at Linköping University of Technology in Sweden. His research activities were devoted to the micromechanics of solid-solid phase transformations and Nickel based superalloys. In 1992, he was involved as a post-doctoral student in an international project (PICS) with the INM Institute at Saarbrücken University on the setting up of constitutive models for the structural relaxation in glass, which were for the first time implemented in the FE code Sysweld. From 1992-2000, he held a researcher position within CNRS in Mulhouse, France, where he carried out research activities in the fields of adhesion, damage and fracture mechanics. He spent one year (1996) in Civil Engineering at TU Delft, where he carried research on the mechanics of generalized continua. He joined ENSEM / LEMTA, UMR CNRS 7563 (Nancy, France) as a full Professor in 2000 and from January 2018 is member of LEM3 laboratory at University of Lorraine.

He has a wide research activity, spanning from theoretical to computational mechanics of materials. In particular, he focused his interest in the mechanics of textiles, biomechanics, or symmetry analysis leading to model reduction and conservation laws preserving numerical schemes. He has investigated the mechanics of fibrous materials, has developed homogenization methods to study generalized continuum models, and has studied computational aspects of slam and large strains homogenization. He gave interesting contributions in shape and topology optimization, has considered symmetries and master curves of dissipative materials and model reduction and has also aimed his efforts in biomechanics, focusing on bone remodelling, mechanics of soft biological tissues, tissue engineering of ligaments and tendons. His research activity has resulted in the development of several novel and alternative concepts cutting across theoretical and numerical methods leading to several awards and prix like the Grand Prix Grand Prix de la recherche de la Société Industrielle de l'Est., in November 2005 and the Scientific award of excellence (French Ministry of Research), 2011-2014 and 2015-2018.

In 1991, he was the author of an innovative paper concerning a finite element analysis of the internal stress distributions in a commercial single crystal nickel base superalloy:

- Ganghoffer, J.F., Hazotte, A., Denis, S., Simon, A., "Finite element calculation of internal mismatch stresses in a single crystal nickel base superalloy" Scripta Metallurgica et Materiala, 1991.

In this work, the internal stress distribution of this material at room temperature and at high temperature was analysed. Moreover, the effect of the discretization due to the mesh geometry on the calculated stress was considered.

He has investigated the adhesion between a rigid flat cylindrical punch and an elastic layer in:

- Ganghoffer, J.-F., Gent, A.N., "Adhesion of a Rigid Punch to a Thin Elastic Layer", The Journal of Adhesion, 1995.

By means of finite element analysis he was able to show a strong effect of Poisson’s ratio for thin layers, small departures from complete incompressibility causing large reductions in stiffness and hence in detachment force.

In a more recent work, a discrete model of a woven fabric structure has been established, whereby nodes endowed with a mass and a rotational rigidity are connected by extensible bars to form a two-dimensional truss:

- Ben Boubaker, B., Haussy, B., Ganghoffer, J.F., “Discrete models of woven structures. Macroscopic approach”, Composites Part B: Engineering, 2007.

In particular with this method, he has obtained the equilibrium shape of this structure by computing the minimum of its total potential energy versus the set of kinematic translational and rotational variables, accounting for eventual kinematic constraints due to contact with a rigid surface.

The macroscopic behaviour of auxetic materials having a network like structure are analysed in terms of their deformation mechanisms and equivalent homogenized mechanical properties thanks to the discrete asymptotic homogenization method in:

- Dos Reis, F., Ganghoffer, J.F., “Equivalent mechanical properties of auxetic lattices from discrete homogenization”, Computational Materials Science, 2012.

In this work, he was able to show that the predicted homogenized properties depend on the slenderness of the beam, hence providing more accurate results. Moreover, this homogenization scheme was able to predict accurately Poisson ratio for lattices hexagonal re-entrant and hexachiral.

The deep interest of Ganghoffer in interdisciplinary research led to several papers in biomechanics and on the study of living tissues. Among them, one of the most impactful was:

- Goda, I., Assidi, M., Belouettar, S., Ganghoffer, J.F., “A micropolar anisotropic constitutive model of cancellous bone from discrete homogenization”, Journal of the Mechanical Behavior of Biomedical Materials, 2012,

in which the microstructure-related scale effects on the macroscopic properties of a cancellous bone were investigated. In particular, he has constructed a Cosserat model of cancellous bone, where the cell walls of the bone microstructure are modelled as Timoshenko beams. The asymptotic homogenization technique is involved to get closed form expressions of the equivalent properties versus the geometrical and mechanical micro-parameters, accounting for the effects of bending, axial, and transverse shear deformations.

In the framework of generalized continuum mechanics, he was author of the seminal paper:

- Rahali, Y., Giorgio, I., Ganghoffer, J.F., Dell'Isola, F., “Homogenization à la Piola produces second gradient continuum models for linear pantographic lattices”, International Journal of Engineering Science, 2015.

In this work, he has shown that the linearized homogenized model for a pantographic lattice must necessarily be a second gradient continuum. More in details, he has proved that two homogenization techniques, namely the heuristic homogenization procedure used by Gabrio Piola and the extension of the asymptotic expansion method up to the second order, produce the same result, i.e. they both lead to a second gradient continuum model.

Another fundamental development of the asymptotic homogenization techniques in the framework of discrete lattice structures was carried on by Ganghoffer in:

- Dos Reis, F., Ganghoffer, J.F., “Construction of micropolar continua from the asymptotic homogenization of beam lattices”, Computers and Structures, 2012.

He was able to obtain the effective elastic micropolar properties for discrete lattice structures, to design a lattice with a hierarchical double scale microstructure, and the calculated micropolar moduli were eventually validated by means of finite elements simulations.

In a very recent paper, he has developed an anisotropic first and second order displacement gradient linear elastic continuum models for two-dimensional random fiber networks:

- Berkache, K., Deogekar, S., Goda, I., Picu, R.C., Ganghoffer, J.F., “Construction of second gradient continuum models for random fibrous networks and analysis of size effects”, Composite Structures, 2017

Starting from the response of the explicit representation of the network, he was able to evaluate its continuum constitutive parameters. Moreover, has determined the scaling of the first and second order moduli with the network parameters, such as the network density and the ratio of the fiber bending to axial stiffness.

The impact of the work of Jean-François Ganghoffer in all the research area in which he has worked is remarkable and he can be considered without any doubt one of the most influent scientist in his framework of study. His creative approach to research has led to building links between traditionally separated disciplines, obtaining in this way fundamental results in a wide set of crucial problems in mechanics and mathematics.

For all exposed reasons the committee, entrusted by the Scientific Committee of the International Research Center MEMOCS with the responsibility of awarding the International Eugenio Beltrami Prize unanimously proposes Professor Jean-François Ganghoffer as recipient of the 2017 edition.