



Colloquium Final Report Form

Please send this report in electronic form to the Secretary General of EUROMECH, within one month after your Colloquium. As an example, please consult the *Report of Colloquium 443* (available at www.euromech.org/colloquia/after.htm).

Title Architected Media: recent developments and scientific challenges

Colloquium No 623 Dates and location May 02-06, 2022, Nancy, France

Chairperson : Jean-François Ganghoffer, Université de Lorraine, Nancy, Fr

Co-Chairperson : Francesco Dell’Isola, University degli Study dell Aquila and MEMOCS, Italy

Is there need of another Colloquium on the same or a related subject? Which year?

A Colloquium on challenges raised by Architected Materials could be organized in 2024 or 2025.

Full registration fee: 300€.

What other funding was obtained? Support from the Université de Lorraine

What were the participants offered? Booklet of Abstracts, coffee breaks, welcome cocktail, banquet, participation to scientific sessions.

Number of members of Euromech (reduced registration fee): 21

Number of non-members of Euromech (full registration fee): 7

Number of participants from each country:

| | | | | | |
|----------------|---|----------------|---|-------------|---|
| Austria | 1 | United Kingdom | | Slovakia | |
| Belgium | 1 | Greece | | Slovenia | |
| Bosnia | | Hungary | | Spain | 1 |
| Byelorussia | | Ireland | | Sweden | |
| Bulgaria | | Italy | 3 | Switzerland | |
| Croatia | | Latvia | | Ukraine | |
| Czech Republic | 1 | Lithuania | | Serbia | |

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| | | | | | |
|---------|----|-------------|---|--------------|----|
| Denmark | | Netherlands | | Montenegro | |
| Estonia | | Norway | | Turkey | |
| Finland | | Poland | | Others | 7 |
| France | 13 | Portugal | | | |
| Georgia | | Romania | | | |
| Germany | | Russia | 1 | Total | 28 |

List names of Applicants to EUROMECH: Chen, Rinaldi, Agarwal, Hamrouni, Luo, Zhaozhen, He

Note that colleagues (permanent staff members) from Université de Lorraine (they were all members of the local organizing committee) did not have to pay the registration fees.

Scientific Report

Please type your report on the following pages. Use additional pages if required. Put the date and your signature at the end.

Colloquium No 623 Scientific Report

The development of additive manufacturing has allowed for the engineering of a new class of materials that obtain their effective mechanical attributes by their inner topological design rather than from their chemical composition, and generate exceptional material performances far beyond those of the base material. Artificial materials of the kind have been named architected materials or metamaterials, as of their potential to yield effective static and dynamic attributes that can well extend the design space of the base material used. The quest for artificial materials that exceed the mechanical performance of conventional materials is driven by both weight and stiffness specification. Lightweight designs with prescribed stiffness attributes are primal objectives in the structural design of mechanical components in different engineering fields, amongst others in morphing and composite engineering. Within the context of isotropy, the mechanical parameters are directly related and restrained within certain limits, so that anisotropic material designs are required to extend the range of accessible mechanical parameters.

During the last decades, material architectures have been developed with ultra-soft or ultra-stiff effective material behaviors that cannot be reached with conventional materials. Exceptional mechanical properties are sought in various applications: the development of lightweight, shear stiff inner material architectures have allowed for the construction of fillers of increased mechanical efficiency for polymer nanocomposites; the relative normal to shear stiffness properties are decisive for the engineering of seismic isolation structures. Carefully designed architectures are used to achieve any combination of linear elastic coefficients to reach novel anisotropy classes. These designs become increasingly important for morphing applications, or in civil / mechanical engineering and biomechanical applications, as for the design of tendons and ligament bio substitutes that exhibit Poisson's ratio values well above the isotropic limits (so-called anti-auxetic behaviors). For the effective mechanical properties of architected materials to be determined, a link between their architecture and their equivalent continuum scale behavior needs to be established.

The Colloquium was split into four sessions:

Session 1: Fibrous materials, biomaterials, composites

Session 2: Homogenization, material design

Session 3: Waves

Session 4: Multiphysical couplings

The objective of the Colloquium was to bring together researchers amongst the community on architected materials to exchange the latest achievements as well as recent research work in the field. The Colloquium did provide state-of-the-art information in the domain of architected materials.

The participants appreciated especially the one session format of the Colloquium which together with the informal atmosphere allowed extensive discussions and

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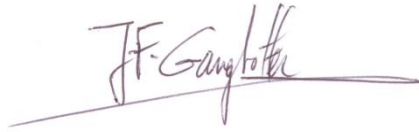
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exchanges amongst participants.

We thank EUROMECH for his financial and scientific support which made the Meeting possible.

Jean-François Ganghoffer
February 18, 2023

A handwritten signature in dark ink, reading "J.F. Ganghoffer". The signature is written in a cursive style and is underlined with a single horizontal stroke.