

## TensiNet symposium 2023 at Nantes Université

Membrane architecture: the seventh established building material.  
Designing reliable and sustainable structures for the urban environment.

TENSINANTES 2023 focuses on the significance and potential of fabrics and foils as established building materials and promotes the use of tensile structures in a world of constant change and adaptation. The optimal use of materials, the realisation of a Eurocode, sustainability and reuse are some of the topics that will be covered, ranging

from research over practical experiences to realisations. The diversity and complementarity within the TensiNet community: suppliers, manufacturers, installers, engineers, architects, researchers & academics, inspired and fed the idea of putting together duos of speakers who will give keynote lectures around the 3 main themes:

- **STRUCTURAL MEMBRANE:** contemporary, innovative, adaptive daring and impactful solutions
- **TENSIONED MEMBRANE STRUCTURES:** the seventh building material
- **STRUCTURAL MEMBRANE:** an answer to issues of the 21st century

### KEYNOTE LECTURES

#### Bouncing Bridge: ephemeral, autonomous and self-supporting pneumatic temporary structure



Bouncing Bridge, prototype diameter 10m © Ramon Sastre

The lecture of Grégoire Zündel and Ramon Sastre covers a series of pneumatic temporary structures for public spaces such as the Bouncing Bridge, all designed by AZC and with Ramon Sastre as their consultant. The key topics of their lecture are Why this project; Tubular pneumatic; Use; Analysis and Fabrication.

#### The Pathways to Zero Carbon for Tensioned Membrane

**Architecture: ongoing actions and next steps** Bruce Danziger and Carol Monticelli will discuss on the one hand how to learn and share effective methods to quantify and reduce the embodied carbon of lightweight structures and on the other hand start the discourse on the advancements of the research on this topic in the on-going transfer to today's design practice.

#### Milestones of ETFE construction methods and starting points for further developments

The lecture of Karsten Moritz and Jean-

Christophe Thomas shows the possibilities of ETFE as an important building material by an overview of milestone projects over the latest 50 years. At the same time, the keynote speakers look ahead to future possibilities taken into account the further development and implementation of LCA's, EPD's and the Eurocode for membrane structures as well as the trend to teach this construction methods more and more at universities.

Finally, the keynote lectures by Louis Ratajczak and Rosemarie Wagner are confirmed. Louis Ratajczak's presentation **Architecture in**



Retractable roof Philippe Chatrier © DVVD Architectes

**motion** will show the process from design to realisation of the retractable roof of the Philippe Chatrier centre court at Roland Garros. With her broad academic background in teaching and research, the

keynote lecture of Rosemarie Wagner **Textile Architecture with or versus today challenges in built environment** attempts to link textile construction to current topics such as reducing fossil raw materials and CO<sub>2</sub> emissions, circularity and energy technology in order to make construction more attractive.

### The retractable roof of the Philippe Chatrier centre court at Roland Garros by DVVD.

The renovation of the Centre Court provides the stadium with a retractable roof. The office DVVD developed a roof made up of light and independent elements, as close as possible to the court, superimposed on each other to allow for light gaps and good ventilation. Inspired by the biplane of the aviator Roland Garros, the elements have been worked like an aeroplane wing, in terms of their shape, their materials and their structure. The curvature and geometry of these "wings" allow them to be interlocked and contribute to the drainage of water and



Retractable roof Philippe Chatrier © DVVD Architectes

to the thermal and acoustic environment of the stadium.

Louis Ratajczak will take you through the design process of this inspiring project during his keynote lecture **"Architecture in motion"** on Wednesday 7th June. The Paris based office DVVD combines the architectural and technical design and economic control of projects as DVVD ARCHITECTES and DVVD INGÉNIEURS are two sister companies that conceive architecture and engineering without barriers. [www.dvvd.fr](http://www.dvvd.fr)

**REGISTRATION IS OPEN** The registration includes attending the 3 days symposium, the cocktail drink, the guided tour Walk the green line and the Conference dinner at the Gallerie des Machines. Register with a few clicks <https://tensinantes2023.sciencesconf.org/registration>

Preliminary **PROGRAMME** The three-day symposium is organised around 3 main topics including **5 keynote lectures & 47 lectures** in plenary and parallel sessions. The film "L'Arc de Triomphe, Wrapped" backstage-engineering for a work of art by büro für leichtbau, Tritthardt+Richter will be shown.

### WEDNESDAY 7<sup>TH</sup> JUNE

08.30-09.15 **Registration**

09.15-09.30 **Welcome & Introduction**

09.30-10.30 **Keynote lecture**

**Bouncing Bridge: ephemeral, autonomous and self-supporting pneumatic temporary structure**

Grégoire Zündel and Ramon Sastre

10.30-10.50 **Coffee break**

10.50-12.55 **Plenary session topic 1**

**Advanced tools for futuristic skins – ETFE**

Massimo Maffei, Antonio Diaferia, Nicola Todesco

**Modeling of impacts on tensile structures**

Adam Bown, Adrian Cabello, Artem Holstov

**Porto Pi shopping center's floating pergolas**

Juan Garcia-Lastra Zorrilla, Juan Rey-Rey, Alejandro Minguez

**PumpItUp, gite mobile for the European cultural capital**

Esch-sur-Alzette 2022

Bernd Stimpfle

**The integration of CAD and FEA for lightweight design and analysis**

Ann-Kathrin Goldbach, Kai-Uwe Bletzinger

13.00-14.00 **Lunch break**

14.00-16.05 **Parallel session A topic 3**

**Integrating sustainability aspects in the teaching of lightweight structures and their comparison with common structures**

Heidrun Bögger-Balz, Sarah Von Der Weth, Karsten Moritz

**The environmental performance of membrane structures**

Zehra Eryuruk, Marijke Mollaert

**A comparative LCA between a Textile Façade Retrofit and conventional solutions**

Giulia Procaccini, Carol Monticelli

**ATLAS architectural membrane as a core element for larger and energy efficient air domes**

Alexandra Sonnenberg

**T-shade: experimental case study conducted to reuse t-shirts as a tensile-shading system**

Amirhossein Ahmadian, Gergely Mátyás Jelinek Jelinek, Aina Radovan, Salvatore Viscuso, Alessandra Zanelli

14.00-16.05 **Parallel session B topic 2**

**Computational design workflow for a complex cable network**

Jef Rombouts, Oriane Guidet, Ludovic Regnault, Klaas De Rycke

**Development and validation of an experimental methodology for the characterization and FEM analysis of fibre-reinforced architectural meshes**

Salvatore Viscuso, Carol Monticelli, Alessandra Zanelli, Alberto Fiorenzi

**Parametric workflow approach in membrane design, from details to construction**

Rémi Journo

**Simulation of functionally graded CNC-knitted membranes**

Yuliya Sinke, Martin Tamke, Mette Ramsgaard Thomsen

**Testing Parameters for uniaxial short-term tensile tests of ETFE foils and their connections**

Dominik Runge, Jörg Uhlemann, Natalie Stranghöner

16.05-16.25 **Coffee break**

16.25-17.15 **Parallel session A topic 1**

**Swatch Omega Headquarters - Multifunctional ETFE-modules in the building envelope**

Karsten MORITZ, Koffi Alate

**Temporary structure Grand Palais Éphémère**

Patrick Vaillant, Beatriz Arnaiz, Feike Reitsma

16.25-17.15 **Parallel session B topic 3**

**Comparison of PE coated PE weave to PVC coated PES weave**

Rogier Houtman

**Advancing the Design of Sustainable ETFE Membrane Structures: Insights from the Lighten Consortium Project**

Mohammad Hoseni Nejabatmehmandi, Alessandro Comitti, Luis Seixas, Adrian Cabello, Adam Bown

17.15-18.15 **Keynote lecture** Architecture in motion

Louis Ratajczak

18.15-20.00 **Inauguration NUIAGE and cocktail drink**

### THURSDAY 8<sup>TH</sup> JUNE

09.00-10.00 **Keynote lecture**

**The Pathways to Zero Carbon for Tensioned**

**Membrane Architecture: ongoing actions and next steps**

Bruce Danziger and Carol Monticelli with Beatriz Ferreyra Vargas and Nathaly Michelle Rodriguez Torres

10.00-10.20 **Coffee break**

10.20-12.25 **Plenary session topic 3**

**Lightweight ideas for a built environment beyond concrete**

Katja Bernert

**How lightweight architecture contribute to sustainability & decarbonization strategy?**

Thomas Bonneville

**6dTEX - Sustainable Composite Structures from 3D Print on 3D Textile**

Claudia Luelling, Sascha Biehl, Roxana Tennert, Gözdem Dittel, Marina Chernychova, Thomas Gries

**Architecture for pigs**

Maxime Durka

**An innovative solar shading device for outdoor thermal comfort**

Adriana Angelotti, Alara Kutlu, Salvatore Viscuso, Andrea Alongi, Alessandra Zanelli

12.30-13.30 **Lunch break**

13.30-15.35 **Parallel session A topic 2**

**Living in the 7th element: Hans-Walter Müller's pneumatics**

Katja Bernert

**Finite element modelling of inflatable beams up to the ultimate stability phase**

Laurent Gomet, Jean-Christophe Thomas

**Analytical, numerical and experimental study of inflatable panels**

Paul Lacorre, Anh Le van, Rabah Bouzidi, Jean-Christophe Thomas

**The calculation of large cable reinforced gas storage systems**

Jürgen Hill

**Textile covers of biogas storage tanks - Interaction between Membrane behavior and Operation of the Gas Membrane**

Rosemarie Wagner, Kai Heinelein

13.30-15.35 **Parallel session B topic 1**

**Infra-minimal surfaces: an intuitive family of shapes for tensile architecture**

Cyril Douthe, Rémi Belloc, Ken'ichi Kawaguchi

**Beyond bending: tension. Membrane structures**

Josep Ignasi de Llorens Duran

**Optimisation of tensegrity systems with tensioned fabrics**

Fevzi Darsik, Meltem Sahin, Caglar Samat

**Retractable membrane roofs as urban shading device**

Liu Dongyuan, Gregor Grünkorn, Julian Lienhard, Ata Chokhachian, Thomas Auer

**Use of Parametric Design in Design to Production Process of a Membrane Facade**

Milan Dragoljevic, Roberto Canobbio

15.35-16.00 **Coffee break**

16.00-17.00 **Keynote lecture**

**Textile Architecture with or versus today challenges in built environment**

Rosemarie Wagner

17.00-19.00 **Walk the green line. Guided walk to the venue of the Galerie des Machines**

19.00-23.00 **Conference dinner at Galerie des Machines**

### FRIDAY 9<sup>TH</sup> JUNE

08.15-09.30 **General Assembly TensiNet**

09.30-10.30 **Keynote lecture**

**Milestones of ETFE construction methods and starting points for further developments in membranes structures**

Karsten Moritz and Jean-Christophe Thomas

10.30-10.50 **Coffee break**

10.50-12.55 **Plenary session topic 2**

**Design and execution of membrane structures acc. to CEN/TS 19102**

Jörg Uhlemann, Bernd Stimpfle, Natalie Stranghöner

**Determination of ULS values of ETFE membrane structures acc. to Eurocode using tensile strength measurements in quality control of production**

Torsten Balster, Carl Maywald, Lazarev Delche

**On the design of membrane structures with the partial safety factor concept – a parameter study on the influence of structural and probabilistic properties**

Martin Fueder, Max Teichgraber, Daniel Staub, Kai-Uwe Bletzinger

**Characterization of polyethylene structure membrane**

Sherryll Patton

**Practical application of a stress-ratio dependent adaptive material model in the structural analysis of textile structures**

Jörg Uhlemann, Mehran Motevalli, Natalie Stranghöner, Daniel Balzan

13.00-14.00 **Lunch break**

14.00-15.40 **Parallel session A topic 3**

**Suntex: weaving solar energy into building skin**

Rogier Houtman, Ahmed Mohamed Ahmed, Pauline van Dongen, Mariana Popescu

**Integration of the Fog water harvesting system in lightweight structure design for emergency camps**

Maria Giovanna Di Bitonto, Nathaly Michelle Rodriguez Torres, Alara Kutlu, Nicolò Elio Giorgiotti, Alessandra Zanelli

**Challenges of measuring sound absorption of ETFE membranes in a laboratory**

Yannick Sluyts, Monika Rychtarikova, Christ Glorieux

**Greentex: Advanced tensile architectural membranes for active and passive cooling of the outdoor & indoor environments via vertical gardens**

Benny Picke

14.00-15.40 **Parallel session B topic 1**

**Corolla, the soft-robotic coworking pod**

Paolo Beccarelli, Ofir Albag, Martin Huba, Roberto Maffei

**The Wave Pavilion from 2014 to 2023: origins, realization and reuse**

Mathieu Lemunier

**TensyDome: A pavilion combining tensegrity ring and tensile architecture**

Nicolas Pauli

**Value enhancement of the roof of the CC Le Polygone Montpellier**

Fabián Ascaso, Beatriz Arnaiz, Ramon Julián, Feike Reitsma

15.40-16.00 **Outlooks & Thanks**

16.00-17.30 **Working Group Sustainability & Comfort Meeting with invited guest Bruce Danziger**

**SUPPORT** This symposium is financially supported by **Nantes Université & Nantes Métropole**

### SPONSORS



<https://tensinantes2023.sciencesconf.org/>



**LOCATION** Nantes Université – Campus Lombarderie, building 2. The campus is from the historical center easily accessible with Line 2: tram stop "Michelet-Sciences". Nantes has an international airport and a TGV railway station.