

# Report and outlook from the 5<sup>th</sup> DCEE workshop

Franco Bontempi<sup>1</sup>, Konstantinos Gkoumas<sup>2</sup>

franco.bontempi@uniroma1.it, konstantinos@gkoumas.eu

<sup>1</sup>Department of Structural and Geotechnical Engineering, Sapienza University of Rome, Italy

<sup>2</sup>StroNGER s.r.l, Italy [now at: European Commission Joint Research Centre, Via E. Fermi 2749 -I- 21027, Ispra (VA), Italy]

## Overview

In his 1969 book “The sciences of the artificial” (MIT Press), Herbert A. Simon, argues that design is the central activity that defines engineering and distinguishes it from the natural sciences. In fact, design is much more than engineering: it encompasses many different skills and disciplines.

In Civil and Environmental Engineering (CEE) in particular, design has typically been housed within each of the civil domains, shrouded by analysis, replaced by standards and building codes, and unable to cross the disciplinary boundaries as it was meant to do.

Yet, many of the greatest challenges that humanity will face in the 21st century will require civil and environmental engineers and architects to develop creative and innovative solutions that will radically alter our infrastructure and the built environment.

The DCEE series of workshops explore what it would mean for design to be a discipline within CEE, what it means for design to be a discipline in other areas of engineering, and the implication for interdisciplinary design in cooperation with other fields such as architecture, urban planning, industrial design, product design and more.

The 5th International Workshop on Design for Civil and Environmental Engineering, held in Rome on October 6-8, explored the nature of design in civil and environmental engineering and provided helpful directions for civil design research.

Over the three days of the workshop, 18 presentations were given, divided in six thematic sessions. On top of that, two plenary lectures enriched further the scientific area of the workshop.

The workshop opened with an introduction by Prof. Bontempi (DCEE 2016 Chair), and a keynote presentation by Prof. Pier Giorgio Malerba (Prof. of Bridge Theory and Design at the Politecnico di Milano), focusing on the conceptual structural design with special focus on bridges.

After that, the first session (chaired by Prof. S-H Hsieh, DCEE 2015 Chair) was on *Design Methodology: architectural and structural design*. Prof. Trovalusci presented a paper on the recovery of the ‘ethic’ of constructions, comparing conceptions from two renowned architects and engineers of the 20<sup>th</sup> century: P. L. Nervi and S. Musmeci. Prof. Kamiyama discussed the aesthetic trends and the sustaining process for Japanese temple gardens, distinguishing three phases in the process (judgment, transformation and sustainment). Prof. Mele presented a study on non-conventional structural patterns for tall buildings: from diagrid to hexagrid and beyond, focusing on inception processes based on natural patterns and structural design.

The second session of the day was again on *Design Methodology: architectural and structural design*. The session started with Prof. Kubota (who also chaired) giving a presentation on the structural form of bridges reflecting the construction processes, starting from theoretical aspects. Dr. Vassilopoulou gave a technical presentation on the design of a temporary deep foundation and the monitoring process for the erection of an arched bridge over an active landslide in the Peloponnese region of Greece. Prof. Trombetti: focused on seismic design of medium size buildings and in particular on sandwich concrete walls and on how a technology of the past improve the seismic performance.

The third and final scientific session of the day was on *Design Methodology: materials and technology*, and was chaired by Prof. Mele. Dr. Manzini provided analytical results and experimental testing for the characterization of a cold-formed steel building system. Prof. Lee gave an overview of strength aspects of carbon nanotube (CNT)-reinforced cementitious composites. Dr. Chiti presented a paper on the thermal and sound performance of lightweight constructions

The first day concluded with a technical visit at the *Palazzo della Civiltà Italiana*, which houses Fendi’s global offices. Dr. Armando Trento, who participated in the renovation of the building, gave the tour.

The second day of the workshop started with a keynote speech by Prof. Charis Gantes (Professor of Steel Structural Design at the National Technical University of Athens), on structural steel design case studies and education aspects.

The first session of the day was on *Interdisciplinary challenges in engineering design* and was chaired by Prof. Lee. Dr. Osaki gave a presentation on the required design philosophy and methodology for the survivors of Japan's 2011 tsunami, based on design practice. Dr. Gkoumas presented the conception and final design of a novel piezoelectric energy harvester that can be implemented in building automation projects. Dr. Galiano presented a study on how social housing can be used for the urban regeneration, presenting cases in Rome.

The second session was again in *Interdisciplinary challenges in engineering design* and was chaired by Prof. Jensen (DCEE 2014 Chair). Prof. Biondini gave a presentation on seismic resilience for aging bridges and evolving road networks, highlighting the importance of a multi-hazard life-cycle analysis. Mr. Espenhein provided a survey of design trends in the framework of sustainability and certification systems, focusing in building sustainability assessment tools in Denmark. Dr. Petrini presented numerical and experimental findings for energy harvesting from flow-induced vibrations.

The third and final session was on the *Design education in engineering design*, and was chaired by Prof. Song. Prof. presented pedagogical learning from a future-oriented interdisciplinary design Course in Taipei. Prof. Hsieh presented a capstone project and the designing a MOOC (Massive Open Online Course) in civil engineering. Dr. Panei presented concepts and findings for the architectural design of recycling areas.

The second day ended with an introduction to DCEE 2017 by Prof. Mistretta (DCEE 2017 Chair), while Prof. Santarelli introduced the second guided tour with a brief presentation of the CISTeC (Research Center in Science and Technology for the Conservation of historical-architectural heritage) and the "Excavating in Ancient Rome - Valley of the Colosseum and Palatine Hill" crowdfunding project.

The third day of the workshop focused on discussions and a round table on the future of DCEE. Dr. Trento started with a presentation the equilibrium between formal simplicity and ecological complexity in the design and construction process for architectural metaphysics. Prof. Mele provided insights, ideas and experiences for the structural design education. Prof. Fioravanti intervened with ideas for architectural design. Prof. Bontempi (DCEE 2016 Chair) provided some closing remarks F. Bontempi, while Dr. Gkoumas (DCEE 2016 Chair) introduced the round table, connecting open issues from the DCEE 2015 workshop in Taipei.

**DCEE 2016 group photo.**



## Outlook

The round table during the third day of the DCEE 2016 workshop focused on important, trending and open aspects of Civil and Environmental Engineering Design and Education, starting from what has been discussed in a workshop within the workshop during the conclusion of DCEE 2015 in Taipei. These aspects and issues provide a connecting link with the DCEE 2017 workshop.

Issues identified as open include:

- Design education.
- Acceptance of methodologies encompassing new technologies.
- Student participation (that should be enhanced in DCEE 2017).
- Local design (design that derives from local tradition, again something important for heritage cities such as Rome and Cagliari).
- Mass design and separation from tailored design.
- The use of words and semantics.
- Design ethics and philosophy of design.
- Interdisciplinary design (the founding stone of the DCEE series of workshops).
- The openness to other sectors
- Artistic aspects of design and reciprocity (e.g. design as art and art as a foundation of design).
- Enhanced networking.
- Cultural shift from CAE design.

DCEE 2016 papers and presentations are available online at the workshop website ([www.dcee2016.eu](http://www.dcee2016.eu)). In addition, peer-review papers from DCEE 2016 will be published together with DCEE 2017. The proceedings will also be available in electronic form, with a proper DOI. The most valuable articles will be selected and recommended for publication, in extended form, in Special Issues of highly reputable journals, such as:

- Engineering, Construction and Architectural Management
- International Journal of Structural Glass and Advanced Materials Research

### Discussion points for the future of DCEE.



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