

Integrated Engineering and Architecture Principles For Sustainable Buildings

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Abstract

Buildings are vital to the development of civilization. They are the very first structures created by humans, first for shelter, and eventually for enhanced family life and neighborhoods. These, neighborhoods have later become villages and cities, bringing both the added benefits and burdens. As the functionality of buildings increased, so has their cost. Energy use in them has become prohibitive with their increasing size. In time they have caused additional environmental concerns, due to their use of other resources, including water and materials. Of course, with buildings and cities, the need for transportation and logistics has increased significantly, which has further severed the environmental concerns. This unsustainable path has eventually yielded rightful discussions about sustainable building and sustainable city concepts.

Naturally, architecture and engineering should be considered in tandem to maximize the benefits of buildings. In the process, the elements of nature, such as sun, wind, earth and air, to be used effectively to maximize the sustainability of the structures and the living conditions for their residents. The state-of-the-art developments in materials, in sensors and in communication technologies need to be coupled with the understanding in passive architecture. This coupling allows the design of smart structures and cities where the daily and hourly changes in the external conditions and requirements can be accommodated easily in building energy use patterns. This necessitates the implementation of integrated and coherent building design principles to have the most significant and the cost-effective solutions and the least environmental impact through reduced energy demand, improved water use, reduced materials consumption, and adaptation of sustainable materials and fabrication methods.

In this presentation, an overview of the recent research and application work conducted at the Center for Energy, Environment and Economy at Ozyegin University will be discussed. The details of sustainable buildings and their extension to sustainable cities will be outlined. An overview of the recent attempts to couple the architecture and engineering for the developments of smarter buildings will be listed and suggestions for new education methodologies will be provided. Also, the work being conducted under a recent collaborative demonstration project, NEED4B, (New Energy Efficiency Demonstration for Buildings, with partners from Spain, Turkey, Italy, Belgium and Sweden; www.need4b.eu) will be summarized.

Biography

M. Pinar Mengüç has completed his BS and M.S. degrees at the Middle East Technical University (METU), Turkey. He has received his PhD in Mechanical Engineering from Purdue University, Indiana, USA in 1985. He joined the faculty at the University of Kentucky the same year, and was promoted to the ranks of associate and full professor in 1988 and 1993, respectively. He is a fellow of the American Society of Mechanical Engineering (ASME) and the International Centre for Heat and Mass Transfer (ICHMT). Professor Mengüç was a visiting professor at the Università degli Studi "Federico II," in Napoli, Italy, and at Massachusetts General Hospital/Harvard University in Boston. He was recognized as an Honorary Professor at ESPOL, Guayaquil, Ecuador in 2006. He served as an Associate Technical Editor of the ASME *Journal of Heat Transfer*, and is currently one of the three Editors-in-Chief of the *Journal of Quantitative Spectroscopy and Radiative Transfer*. He has co-organized five international symposia on Radiation Transfer, which were held in 1995, 1997, 2001, 2004, and 2007. The 2010 Symposium was dedicated to him along with two other researchers for their contributions to the radiation transfer community.

Mengüç's research expertise includes radiation transfer, nano-scale transport phenomena, applied optics, and sustainable energy and its applications to buildings and cities. He has authored/co-authored more than 100 refereed journal articles, publishing them in more than 35 different international academic journals. In addition, he has more than 150 conference papers, several book chapters, has four assigned and two pending patents, and presented more than 90 invited and key-note lectures around the World. He is one of the co-authors of the fifth edition of a well-known text book, "Thermal Radiation Heat Transfer" along with John R. Howell and Robert Siegel. He has a second book, co-authored with one of his former students, Basil Wong, titled "Thermal Transport for Applications in Micro/Nano-Machining." He has guided more than 50 MS and Ph.D. students and post-doctoral fellows both in the US and in Turkey, and was the investigator/co-investigator of more than 50 research projects. He is the owner of a start-up company on particle characterization with another of his former Ph.D. students. He served as the director of the Nano-Scale Engineering Certificate Program at the University of Kentucky. He is the Turkish Delegate to the European Framework programs (FP-7) on energy related topics. Since December 2008, he is the coordinator of the Mechanical Engineering program at Özyeğin University in İstanbul, and serves as the Director of Center for Energy, Environment, and Economy (CEEE).