

MULTISCALE MODELING OF CONCRETE AND CONCRETE STRUCTURES

IN HONOR OF THE 85TH BIRTHDAY OF PROF. HERBERT A. MANG

Keywords: concrete, multiscale modeling, multiphysics modeling, machine learning, concrete structures, structural analysis

ABSTRACT

The special session is dedicated to celebrating the 85th birthday of Prof. Herbert A. Mang, Institute for Mechanics of Materials and Structures, TU Wien, Vienna, Austria. The topic “Multiscale Modeling of Concrete and Concrete Structures” is to be understood in a broad and inclusive fashion. This includes methodological developments regarding multiscale and multiphysics modeling of all types of concrete made from traditional and innovative, low-carbon binders: normal-strength concrete, high-strength concrete, lightweight concrete, fiber-reinforced concrete, sprayed concrete, 3D-printed concrete, etc. Length scales of interest range from atomistic via molecular, nano, micro, and meso up to the macro scale of concrete and concrete structures. All time scales relevant to the behavior of concrete subjected to different environmental conditions and static as well as dynamic loading are also included, e.g., those relevant to early-age hydration, shrinkage, creep, transport and deterioration processes, impact and blast loading, etc.

Approaches to material and structural modeling supported by innovative experimental protocols are particularly welcome. This includes physics-based, data-driven, and hybrid approaches, as well as emerging applications of machine learning and artificial intelligence in multiscale modeling. Contributions exploiting large experimental or monitoring datasets, advanced sensing techniques, model updating, and digital-twin concepts are equally encouraged. Applications of predictive material models to multiscale analyses of unreinforced and reinforced concrete structures remain a central focus of the session.

Structures of interest include pavements, bridges, tunnel linings, power plants, cooling towers, and high-rise buildings. Structural analyses supported by measurement data from real-scale testing and/or monitoring of existing structures, contributions dealing with serviceability and ultimate limit states under regular and exceptional load cases, as well as research targeted at reducing the CO₂ footprint, extending service life, and increasing the durability and resilience of engineering infrastructure are especially encouraged.