

Discipline Committee 1 (DC1) – Technical Sciences – Panel Specialization

P101 Mechanical Engineering

Kinematics and dynamics of bodies and systems of bodies and mechanisms (motion of bodies, mechanical vibrations and damping); elasticity and strength of mechanical structures including biomechanical applications, durability and reliability of structures; diagnostic methods, especially vibrodiagnostics (acoustics and wave propagation, vibration isolation, elastic machinery mounting); tribology; thermodynamics and fluid mechanics including aero- and hydro-elasticity, physical and thermodynamic properties of fluids; mechatronics of machinery, robotics, smart structures design.

P102 Electrical Engineering and Electronics

Electrical engineering: theoretical electrical engineering; microsystems and microactuators; microprocessors and programmable circuits; control and safety systems; electrical power engineering; electrical machines, appliances and drives; power semiconductor systems; electromagnetic compatibility; intelligent electromechanical systems; electrical materials and their applications.

Electronics and photonics: lasers and laser technology; optics, non-linear and fibre optics; photonics; electronics; micro- and nanoelectronics; radioelectronics; microwave technology; antennas, electromagnetic wave propagation; telecommunications technology; modelling of electronic and electrical systems; measurement technology; electronic and optical sensors.

Interdisciplinary projects must involve research with non-trivial contribution to the field of electrical engineering and electronics.

P103 Cybernetics, Artificial Intelligence and Information Processing

Theoretical cybernetics; analysis and synthesis of nonlinear dynamic systems; automatic control theory; adaptive and predictive control; signal and system theory; state reconstruction; statistical dynamics; filtering theory; system identification and nonlinear estimation; fuzzy set theory; multiagent systems; digital signal and data processing; software design theory; artificial intelligence; theoretical foundations of data science and statistical modelling; machine learning; evolutionary algorithms; general signal and biosignal processing; communication and information systems modelling; digital systems design and architecture; digital systems diagnostics and fault-tolerant systems; reliability of systems; communication systems theory.

P104 Building Materials, Architecture and Civil engineering

Building materials: concrete: structure and mechanical properties; micro- and nano-mechanics of concrete and other ceramic materials; steel, wood, glass, plastics as building materials; mechanics of materials of historical buildings; composite and memory materials for building construction and reconstruction; recycled materials and materials from energy and industrial production; prediction, optimization and experimental determination of properties of building materials; theoretical modeling and experimental research of building materials.

Interaction with external influences: humidity, temperature, aggressive environments, electromagnetic fields, radiation; degradation of building materials, materials resistant to environmental influences; aeroacoustics of wind in housing formations, heat accumulation and recovery.

Architecture and civil engineering: Methods of perceiving and evaluating architecture and urban units; architectural objects, typology of architecture (functional, operational and spatial characteristics); architectural ensembles, settlements, (development, characteristics); typology of the city, spatial shaping of the city urban strategies, urban systems, planning for the development of settlements and territories; building physics and its influence on architecture (intelligent buildings, energy-efficient design); contemporary technologies in relation to architecture, influence on its form; software support for architectural creation; monuments preservation, historical architecture and specific use of contemporary or historical technological processes; infrastructure of settlements, cities and agglomerations.

P105 Structural Mechanics and Construction, Fluid Mechanics and Geotechnics

Structural mechanics: mechanics of deformable media; statics and dynamics of bodies, environments and structures, stochastic statics and dynamics in construction; interactions of bodies and flowing fluids; aerodynamics and aeroelasticity of buildings, stability of systems under static and dynamic effects, including technical seismicity, seismic engineering; static and dynamic interaction of subsoil and structural systems; biomechanics of the human skeletal system.

Fluid mechanics: fluid mechanics motivated by construction and water management issues; dynamics of river flows and water management systems; flow of multiphase mixtures; air flow inside buildings; geohydraulics.

Construction: statics and dynamics of engineering structures; statics and dynamics of transport structures; road mechanics; mechanics of hydrotechnical and water structures; systems of diagnosis, monitoring and evaluation of the condition of structures, identification of systems; service life and reliability of building structures; material fatigue and structural failure mechanics.

Geotechnics: soil mechanics, rock mechanics; geomechanics of buildings; mechanics of earth structures; mechanics of underground engineering structures; soils with controlled properties; montane sciences.

P106 Technical Chemistry

Basic research in the fields of chemical engineering; chemical technology; transport processes (mass, momentum, energy, information transfer) and separation phenomena; catalysis, kinetics, catalysts; multiphase systems and multiphase hydrodynamics; reactor engineering (macro, micro, nano); engineering and technology of processing of macromolecular substances, natural materials and non-metallic materials; processes applied in environmental protection (elimination of pollutants, etc.), transformation of energy raw materials and chemical energy storage; efficiency and safety of chemical processes.

The investigated reaction-transport phenomena, the preparation procedures or the properties of the products produced must be subjected to experimental validation and/or analysis using mathematical models which clearly indicate the possible future contribution to the technology and engineering of chemical, biochemical and biological processes.

The Technical Chemistry Panel does not accept project proposals focused purely on: synthesis of new molecules or materials, materials characterisation, research of new techniques for the analysis of materials and molecules, computational chemistry focused on the interactions of individual molecules.

P107 Metallic materials – preparation and properties

New materials based on metals; Preparation and processing of metallic materials - metallurgical processes, properties of metal melts and slags, foundry, forming, welding, machining, heat treatment, surface treatment; Characterization of metallic materials in terms of mechanical, thermophysical, corrosion and tribological properties, especially focusing on the study of the relationship between the preparation process, phase composition, microstructure and properties.

P108 Materials Sciences and Engineering

This panel focuses on fundamental research in materials science and engineering, i.e. the study of the preparation, structure and properties of inorganic non-metallic, polymeric, composite materials, including materials for electronics, sensors and biomedical applications (biomaterials). It is primarily concerned with the investigation of the following material properties: physical (electrical, optical, thermal, mechanical, tribological, etc.), chemical (degradation, resistance, composition, structure, etc.), surface and biological (biomechanical and material interaction with cells and tissues). The panel also includes advanced experiments, theoretical approaches to the synthesis of new materials, and simulations in materials research.

The panel does not include projects focusing on: metallic materials, thermodynamics and fluid mechanics, building materials, analytical and physical chemistry, chemical engineering, catalysts, drug delivery materials, cell biology, in vivo assays.