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Multiscale Mathematical Modeling

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The prediction of large-scale behavior using finer scale theory is a key goal of modern natural sciences and is of particular importance for numerous engineering applications. Problems in multiscale modeling are often interdisciplinary in nature. Recent major progress in this area is due to the development of advanced computational and experimental methodologies, along with the establishment of powerful mathematical frameworks operating with multiple length and time scales. The latter is the focus of the current Special Issue, aiming to address the state of the art on the subject and is oriented towards a broad scientific and engineering audience.

Specific topics in this Special Issue include theories of discrete systems, elasticity and hydroelasticity, composite materials, metamaterials and quasicrystals, hydromechanics, biomechanics, geomechanics, and tribology. Among the methods of mathematical multiscale modelling, asymptotic approaches stand out. The presented articles demonstrate the power of continualization, homogenization, along with regular and singular perturbation methods and Padé approximants for solving a variety of multiscale problems. Examples of multiscale numerical and statistical analysis are also included.

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