Abstract:
Homogenization is a mathematical theory that takes a microscale system and upscales it. Applications of homogenization are multiple, e.g. in understanding biological tissue behavior, oil and gas extraction and geothermal energy systems. In 1989, Gabriel Nguetseng in [1] introduced the concept of two-scale convergence in the homogenization context. This has significantly simplified proofs and has, therefore, facilitated the applicability of the theory. In 2003 and 2004, he generalized this concept in [2, 3] even further with the notion of a homogenization structure.
In this talk, I will explain the notion of homogenization structure and link it to both two-scale convergence and Σ-convergence. I will start with the introduction of homogenization algebra as a C*-algebra of two-scale converging functions and then show step-by-step how the structure of the domain will naturally lead to the known Sobolev-spaces in homogenization, homogenization structures, Σ-convergence, the uniqueness of homogenization and the application of homogenization structures in the form of cell problems, homogenization matrix and homogenized problem.

[1] G. Nguetseng, 1989, A General Convergence Result for a Functional Related to the Theory of Homogenization, SIAM J. Math. Anal. 20 (3), 608-623
[2] G. Nguetseng, 2003, Homogenization Structures and Applications I, Z. Anal. Anwend. 22 (1), 73-107
[3] G. Nguetseng, 2004, Homogenization Structures and Applications I, Z. Anal. Anwend. 23 (3), 483-508