

DEPARTMENT OF MATHEMATICS AND COMPUTER SCIENCE
UNIVERSITY OF SOUTHERN DENMARK, ODENSE

Mathematics seminar

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Visualising and computing invariants of patterns via pattern-equivariant Poincaré duality

Tuesday 24 January 2017, 14:15-15:15
IMADA seminar room

Abstract

A decoration of Euclidean space is aperiodically ordered if it lacks translational symmetry and yet is still, in a some sense, highly ordered. The most famous examples of aperiodic order are the Penrose tilings which, despite lacking translational symmetries, have the property that any given finite patch may be found within some fixed radius (depending only on that patch) of any point of the tiling. In this talk I shall explain how one begins to study these systems topologically, by associating to them moduli spaces of associated families of patterns. These techniques are closely related to approaches via noncommutative geometry, which establish a connection to physical properties of quasicrystals based upon these patterns. Topological invariants of these 'pattern spaces' may often be interpreted in a highly geometric way via the so-called pattern-equivariant (PE) formalism, first introduced by Kellendonk and Putnam. I shall explain how these invariants can be given approachable alternative depictions via a Poincaré duality result, using the Penrose tilings as our running example. The resulting PE homology groups can be directly computed for tilings with a hierarchical structure. The PE homology may be incorporated into a calculation of the Čech cohomology of the Euclidean hull of the Penrose tilings.