IPM

Colloquium

Reinhard Diestel, Hamburg

Infinite graphs and matroids

``and their mysterious topological link''

Abstract: Many fundamental results in structural finite graph theory extend to infinite graphs only when we view these together with their ends, points at infinity to which their infinite paths converge. Paths and cycles featuring in the finite theorems then translate to arcs and circles in the compact topological space which the infinite (locally finite) graph forms together with its ends.

In 2013, this intrinsically topological view of infinite graphs led to a break-through in matroid theory: it gave us the clues of how to axiomatize infinite matroids in a way compatible with matroid duality, one of the key features of finite matroid theory. This solved a 1960 problem of Rado, one of the founders of matroid theory, and has since led to a re-launch of infinite matroid theory.

Yet while topology was key to defining the graph structures that led to this discovery of infinite matroids - the `topological' spanning trees of graphs form the bases of some matroids which infinite matroid duality required to exist, but which were unknown - it no longer features explicitly in the axioms on which the new infinite matroid theory is based. In this way, matroid theory can now inform infinite graph theory: by providing combinatorial descriptions (via matroid duality) of what used to be entirely topological phenomena in the end-compactification of graphs.

Might infinite matroid theory have similar suprises in store in other areas too, e.g. in algebra?

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