

# Structurally Tractable Graph Classes

Szymon Toruńczyk  

Institute of Informatics, University of Warsaw, Poland

---

## Abstract

*Sparsity theory*, initiated by Ossona de Mendez and Nešetřil, identifies those classes of sparse graphs that are tractable in various ways – algorithmically, combinatorially, and logically – as exactly the *nowhere dense* classes. An ongoing effort aims at generalizing sparsity theory to classes of graphs that are not necessarily sparse. *Twin-width* theory, developed by Bonnet, Thomassé and co-authors, is a step in that direction. A theory unifying the two is anticipated. It is conjectured that the relevant notion characterising dense graph classes that are tractable, generalising nowhere denseness and bounded twin-width, is the notion of a *monadically dependent class*, introduced by Shelah in model theory. I will survey the recent, rapid progress in the understanding of those classes, and of the related monadically stable classes. This development combines tools from structural graph theory, logic (finite and infinite model theory), and algorithms (parameterised algorithms and range search queries).

**2012 ACM Subject Classification** Theory of computation → Finite Model Theory; Theory of computation → Complexity theory and logic; Theory of computation → Fixed parameter tractability; Mathematics of computing → Graph algorithms

**Keywords and phrases** Structural graph theory, Monadic dependence, monadic NIP, twin-width

**Digital Object Identifier** 10.4230/LIPIcs.STACS.2024.3

**Category** Invited Talk



© Szymon Toruńczyk;  
licensed under Creative Commons License CC-BY 4.0

41st International Symposium on Theoretical Aspects of Computer Science (STACS 2024).

Editors: Olaf Beyersdorff, Mamadou Moustapha Kanté, Orna Kupferman, and Daniel Lokshtanov;  
Article No. 3; pp. 3:1–3:1



Leibniz International Proceedings in Informatics  
LIPICs Schloss Dagstuhl – Leibniz-Zentrum für Informatik, Dagstuhl Publishing, Germany

