Marcelo Fiore

Department of Computer Science and Technology, University of Cambridge, UK

An algebraic combinatorial approach to the abstract syntax of opetopic structures

The starting point of the talk will be the identification of structure common to tree-like combinatorial objects, exemplifying the situation with abstract syntax trees (as used in formal languages) and with opetopes (as used in higher-dimensional algebra). The emerging mathematical structure will be then formalized in a categorical setting, unifying the algebraic aspects of the theory of abstract syntax of [**?**, **?**] and the theory of opetopes of [**?**]. This realization conceptually allows one to transport viewpoints between these, now bridged, mathematical theories and I will explore it here in the direction of higher-dimensional algebra, giving an algebraic combinatorial framework for a generalisation of the slice construction of [**?**] for generating opetopes. The technical work will involve setting up a microcosm principle for near-semirings [**?**] and subsequently exploit it in the cartesian closed bicategory of generalised species of structures of [**?**]. Connections to Homotopy Type Theory, (cartesian and symmetric monoidal) equational theories, lambda calculus, and algebraic combinatorics will be mentioned in passing.

References

[1] J. Baez and J. Dolan, Higher-dimensional algebra III. n-categories and the algebra of opetopes, *Advances in Mathematics* 135(2):145–206, 1998.

[2] M. Fiore, Second-order and dependently-sorted abstract syntax, *Proceedings of the 23rd Annual IEEE Symposium on Logic in Computer Science* (*LICS'08*), pages 57–68, 2008.

[3] M. Fiore, N. Gambino, M. Hyland, and G. Winskel, The cartesian closed bicategory of generalised species of structures. *J. London Math. Soc.*, 77:203–220, 2008.

[4] M. Fiore, G. Plotkin and D. Turi, Abstract syntax and variable binding, *Proceedings of the 14th Annual IEEE Symposium on Logic in Computer Science* (*LICS'99*), pages 193–202, 1999.

[5] M. Fiore and P. Saville, List objects with algebraic structure. *Proceedings of the 2nd International Conference on Formal Structures for Computation and Deduction* (*FSCD 2017*), No. 16, pages 1–18, 2017.

[6] S. Szawiel and M. Zawadowski, The web monoid and opetopic sets, *Journal of Pure and Applied Algebra*, 217:1105–1140, 2013.