Peripatetic Seminar on Sheaves and Logic 87

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Abstracts

Homotopy algebra

André Joyal, University of Quebec at Montreal

Many aspects of universal agebra can be extended to homotopy invariant algebraic structures via the theory of quasi-categories. The category of (extended) algebraic theories has the structure of a symmetric monoidal closed 2-category. We conjecture that the n-fold tensor power of the theory of groups is the theory of n-fold loop spaces. We give a characterisation of homotopy varieties which strengthen a theorem of Rosicky.

A combinatorial theory of geometric distributions

Anders Kock, University of Aarhus

"Geometric distribution" is a generalization of the "direction fields" of elementary calculus (so have nothing to do with the (Schwartz-)distributions of functional analysis). The famous Theorem of Frobenius asserts that a sufficient condition that a geometric distribution is integrable is that it is "involutive"; the notion of involutive becomes in the setting of synthetic differential geometry a simple combinatorial property.

Problems of analysis in some toposes

Gonzalo Reyes, University of Montreal

Ordered face structures

Marek Zawadowski, University of Warsaw

Ordered face structures correspond to all possible shapes of cells in many-to-one computads. Under this correspondence the principal ordered face structures correspond to the shapes of indets (generators) of many-to-one computads. This is why the presheaf category on the category of principal face structures is equivalent to the category of many to-one computads and hence to the category of multitopic sets as well.

In my talk in Carveiro (CT 2007), I have given a brief description ordered face structures and I have spent more time on describing their properties. In this talk I want to concentrate more on ordered face structures themselves. Explaining in details the primitive notions and axioms defining them. If time permits, I will sketch some additional notions and constructions that are relevant to them.

Tilting and quasiabelian categories

Apostolos Beligiannis, University of Ioannina

Polynomial functors and trees

Joachim Kock, Universita Autonoma, Barcelona

The aim of this talk is to explain the slogan "trees are to polynomial monads as linear orders are to categories", and to make it precise. First I use polynomial functors to give a formal and conceptual construction of a category of trees (the Ω of Moerdijk and Weiss), and describe its main features. Then I explain how polynomial endofunctors and polynomial monads are obtained by gluing together trees, and give a nerve theorem characterising polynomial monads among all presheaves on the category of trees. These constructions and results fit into a general machinery developed recently by Weber, but contain some new interesting twists due to the fact that the category of polynomial endofunctors is not itself a presheaf category. (Yet polynomial endofunctors have elements and canonical diagrams.) I dedicate this work to my father.

Toposes of self-similar systems

Panagis Karazeris, University of Patras (Joint work with Apostolos Matzaris and Grigoris Protsonis)

We show that the Jónsson - Tarski topos associated with a bimodule M on $\mathcal{A}$ (assumed to be pointwise connected-limit-flat) arises as the topos of sheaves on the category $\mathcal{A}_M$, constructed by J. Worrell, for a suitable topology. Exploiting this we show that the points of such a topos are self-similar systems, i.e connected-limit-flat functors $F : \mathcal{A} \to \text{Sets}$ with $M \otimes F \cong F$.

Terminal Coargebras
Eugenia Cheng, University of Sheffield (Joint work with Tom Leinster)

Coalgebras for endofunctors may seem rather lacking in structure at first sight - unlike coalgebras for comonads, they satisfy no axioms. However, terminal coalgebras for endofunctors turn out to be rather interesting. A lemma of Lambek tells us that these are fixed points for the endofunctor in question, and a theorem of Adamek gives us an explicit construction, provided we have enough limits and colimits in that are relevant to themour ambient category. One consequence is that we have a way of constructing infinite versions of algebraic structures that are usually constructed by induction and thus can usually only be finite. Examples include infinite words, infinite trees and strict ω-categories. In this talk we will give a new example: an ω-dimensional version of Trimble's weak n-categories.

The cardinality of a metric space
Tom Leinster, University of Glasgow

In the last couple of years it has become apparent that there is a sensible definition of the "Euler characteristic" or "cardinality" of a category. This notion extends easily to enriched categories, and in particular to metric spaces. I will explain what the cardinality of a metric space is, and describe some relations with convex geometry and geometric measure theory.

The application of quantaloidal calculus in Quantum Mechanics
Emmanouel Galatoulas, University of Athens

Homotopy theory of posets
George Raptis, University of Oxford

The stack quotient of a groupoid
Anders Kock, University of Aarhus

We consider the notion of lift of a diagram over a categorical fibration. Descent problems may be formulated in these terms. In this context, we can describe a precise sense in which the stack of torsors over G is a quotient of G (G a groupoid).