




CENTRO DE  
**MATEMÁTICA**  
UNIVERSIDADE DO PORTO

# CMUP New Members Meeting

November 12, 2021

Room FC1.027

[www.cmup.pt](http://www.cmup.pt)

Hour	Speaker	Talk
9:30	<b>Helena Reis</b> Vice-Director of CMUP	<i>Opening session</i>
9:35	<b>Jan Wächter</b>  <i>Algebra, Semigroups, Automata and Languages</i> Research Interests: Algebraic decision problems	<i>Automata and Algebra</i> <p>Generally, I am interested in the combination of methods from Theoretical Computer Science and Algebra. To give you an idea of what this means, I will introduce you to some topics belonging to the two parts of my work program for CMUP. As examples, we will discuss the on-going projects I have been working on during the last months.</p> <p>Here, we will first look into a combinatorial description of a class of finite semigroups (more precisely, the variety DAb, in which every regular D-class is an abelian group) and see how this is potentially also useful for decision problems over this class.</p> <p>For the second part, we will have a brief look at how finite automata (which are basically finite di-graphs with edges labelled by an input symbol and an output symbol) can be used as an alternative way to generate semigroups and groups with sometimes quite exotic properties. We will encounter some results relating the structure of the generating automaton to the algebraic structure of the generated object.</p> <p>Caveat: We will discuss some very recent work, which is sometimes even still in flux and has not been published or even peer-reviewed yet.</p>
10:15	<b>Eliana Duarte</b>  <i>Geometry</i> Research Interests: Computational commutative algebra	<i>Toric varieties in Geometric Modeling and Algebraic Statistics</i> <p>This is an overview talk on how toric varieties appear naturally in applied settings. In these areas, the algebraic and geometric tools that we use to study these varieties can be used to gain insight for their practical use.</p>
10:55	Coffee Break	
11:20	<b>Théophile Caby</b>  <i>Dynamical systems</i> Research Interest: Dynamical Systems, Extreme Value Theory, Fractal Geometry	<i>Statistical and geometric properties of observations of dynamical systems</i> <p>To study high-dimensional dynamical systems, physicists often work with observational data that do not constitute actual trajectories of the system under study, but can rather be seen as projections of the system into a space where measurements can be made (usually, <math>R^n</math>). To model this, we compute, along a typical trajectory of the system, the value of an observable, that is a smooth function from the phase space to the space of observations. Using Extreme Value Theory, we study the statistical properties of different quantities of interest associated with this observable (recurrence times, number of visits to small regions of the observation space, time of first synchronization). The limit distributions that we obtain are Gumbel laws whose scale parameters relate to fractal dimensions that are characteristic of the image measure (local dimensions and generalized dimensions). With a good choice of observable, we show that one can use these results to access the geometric structure of the real underlying attractor. Different applications will be presented.</p>
12:00	Closing	