Mathematics and Music: algebraic, categorical and computational methods in the maths/music research (Part 1)

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Timetable: 18 hrs., from May 3 to May 14. Moreno Andreatta: 3-4-5-6 May 15:30 - 17:30. Emmanuel Amiot: 7-10-11 May from 15:30 - 17:30. Greta Lanzarotto 12-13 May from 15:30 - 17:30. The course will be held online at: https://unipd.zoom.us/j/84271750221?pwd=L0Jib1VBMVRzVCTUUjVVe8xR1VkZz09
Meeting ID: 842 7175 0221 - Passcode: MathMusic

Course requirements: Basics of Algebra and Geometry.

Examination and grading:

SSD: MAT/02, MAT/03.

Aim: Despite a long historical relationship between mathematics and music, the interest of mathematicians for Music Theory is a recent phenomenon. The aim of this doctoral course on mathematics and music is to give a structural multidisciplinary approach into computational musicology making use of advanced mathematical tools. It is based on the interplay between different mathematical disciplines: algebra, topology and category theory. New results and perspectives are possible on important challenges such as revealing through suitable mathematical tools musical properties, studying the computational aspects of musical processes, preparing the automatic classification of musical styles.

Course contents: The first part of the course provides an introduction of the most active research axes in contemporary ‘mathemusical’ research by focusing on the SMIR project, a multidisciplinary research project based at IRMA (Institut de Recherche Mathématique Avancée) and carried on in collaboration with the Music Representation Team at IRCAM (Paris) and many researchers belonging to the international Society of Mathematics and Computation in Music (SMCM). After a survey on a panoply of research topics, special emphasis will be given to the topological representation and algebraic formalisation of different harmonic music spaces (the Generalized Tonnetze). Discrete Fourier Transform on algebraic structures will be used in order to provide computational tools for the study of chords, scales, rhythms and other musical parameters. The course will also include a special focus on tiling problems music composition and their link with Fuglede Spectral Conjecture (still open in dimension 1 and 2).

References:

• Moreno Andreatta, “From music to mathematics and backwards: introducing algebra, topology and category theory into computational musicology”, in M. Emmer and M. Abate (eds.), *Imagine Math 6 - Mathematics and Culture, XXth Anniversary*, Springer, 2018, pp. 77-88. Available at:

• Luis Bigo, Moreno Andreatta, “Topological Structures in Computer-Aided Music Analysis”, in D. Meredith (ed.), *Computational Musicology*, Springer, 2015, p. 57-80. Available at: