Politecnico di Torino
Dipartimento di Scienze Matematiche "G. L. Lagrange"

DISMA Dipartimento di Scienze Matematiche G. L. Lagrange
ECCELLENZA 2018 • 2022

Friday October 8th, 2021 at 4:30PM
Hosted on: Zoom

COLLOQUIUM

Prof. **Rustum CHOKSI**
McGill University

Voronoi Tessellations: Optimal Quantization and Modelling Collective Behaviour

Abstract. Voronoi tessellations give rise to a wealth of analytic, geometric, and computational questions. They are also very useful in modelling. This talk will consist of two parts.
In the first, I will address simple yet rich questions of optimal quantization – or optimal centroidal Voronoi tessellations (CVT) – on the 2D and 3D torus as well as the 2-sphere. I will address both Gersho's conjecture (a crystallization conjecture which asserts the periodic structure of the optimal CVT, as the number of generators tends to infinity) and a new hybrid numerical method for accessing low energy CVTs with tiny basins of attraction.
In the second part of the talk, I will present a new dynamical model for generic crowds in which individual agents are aware of their local Voronoi environment—i.e., neighbouring agents and domain boundary features—and may seek static target locations. The model incorporates features common to many other "active matter" models like collision avoidance, alignment among agents, and homing toward targets. However, it is novel in key respects: the model combines topological and metrical features in a natural manner based upon the local environment of the agent's Voronoi diagram. With only two parameters, it captures a wide range of collective behaviours.
This talk comprises joint works with Xin Yang Lu (Lakehead University) and with Ivan Gonzalez, Jean-Christophe Nave, Jack Tisdell (all at McGill University).

Bio. Rustum Choksi is Full Professor of Analysis at McGill University in Montreal. He earned his PhD from Brown University and worked as a postdoc at Carnegie Mellon University's Center for Nonlinear Analysis in Pittsburgh and the Courant Institute in New York. His research focuses on calculus of variations and nonlinear pdes, with particular attention to applications to problems of a physical, biological and engineering nature. He gave excellent contributions on diblock copolymers, on image processing, on the growth of polycrystalline materials and finally on Voronoi tessellations, on the non-local Cahn-Hilliard model and on Gamow's liquid drop model.