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Professor at Eindhoven University of Technology, the Netherlands**October 18, 2019 – 10:00 am**Université de technologie de Compiègne
Amphi Gauss – Centre de recherche de Royallieu
Rue Personne de Roberval
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Can physics help to understand the dynamics of human crowds?

Abstract:

How do we move when walking alone or in dense crowds? Is it possible to develop mathematical models capable of accurately describing the statistical properties of pedestrian dynamics? These challenging and fascinating scientific questions can also directly impact on our daily comfort, and even safety, when visiting crowded urban areas.

In recent years we have been conducting a number of real-life experiments aimed at providing some answers. We employ 3d depth-sensor cameras to observe the dynamics of millions of pedestrians in a variety of real-life settings: from a small University corridor, to a museum entrance, city festivals, crowded train stations, etc. Our 3d depth-map cameras have allowed us to record pedestrian trajectories with high space and time accuracies while preserving the privacy of single individuals. Thanks to the large acquired datasets we could study fluctuations and not just average behaviours. To describe what we observed we have been employing the mathematical tools that physicist ordinarily use with success to describe other kinds of phenomena. In this talk we will present some of them and we will discuss how the dynamics of single individuals can be modeled in terms of path integrals or of Langevin equations. We will discuss how to model collisions between individuals, in low density crowds, and how to learn space-time patterns. Finally we will discuss experiments that we conducted in order to investigate the possibility to nudge human crowds via light stimuli.

Bio:

Federico Toschi is full professor at the departments of Applied Physics and of Mathematics and Computer Science at Eindhoven University of Technology (TU/e). Federico Toschi graduated (magna cum laude) in Physics at University of Pisa (Italy) and at Scuola Normale Superiore di Pisa (Italy, 1995). In 1998 he received his PhD in Physics from the University of Pisa (Italy) with a thesis on the fundamental statistical properties of fluid dynamics turbulence. He has worked at the University of Twente (The Netherlands, 1990-2001), at Ecole Normale Supérieure de Lyon (France, 2001) and at the Istituto per le Applicazioni del Calcolo of the National Research Council (Italy, 2001-2008). In 2008, he was appointed full professor of Computational Physics of Multi-scale Transport Phenomena at Eindhoven University of Technology (TU/e, the Netherlands). Federico is a fellow of the American Physical Society (APS, 2015) and of the European Mechanics Society (2012); he has been a visiting scientist at University of Chicago (USA), Stanford (USA), Cambridge (UK) and Tsinghua (China). He has published more than 200 peer-reviewed papers, co-edited 3 books and provided more than 100 invited talks and seminars. His interests focus on the emerging complexity in challenging multi-scale problems at the crossroad between statistical physics, fluid mechanics, soft condensed matter and bio-physics. He served the scientific community by chairing two COST Action on “Particles in turbulence” and “Flowing matter”. He is currently editor for the Journal of Turbulence.