DATA-DRIVEN MODELS FOR STRUCTURAL COLOURS AND PATTERNS ON ARBITRARY SURFACES

presented by

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Abstract:
Structural colours lend richness to visual experiences and computer graphics (CG) aims at modelling them realistically while simulating virtual-worlds. Most of these colours arise due to wave-optical phenomena such as interference, diffraction, sub-surface scattering, polarisation or their concurrence. Advance methods involving Wigner distribution functions (WDFs), finite difference time domain (FDTD) formulations or augmented light-fields exist to model structural colours into bidirectional scattering distribution functions (BSDFs). However, such methods are computationally too complex and/or inept to handle the large-scale, real-world, nano-structural information which is essential for realism. Modelling such colourations and patterns on arbitrary surfaces involve an additional level of complexity. In this talk, I will present some of my past as well as present research work dealing with interactive rendering of structural colours and pattern formation on arbitrary surfaces. More importantly, I will propose data-driven and image-based, parameterised modelling approaches for realistically and interactively simulating complex, thin-volume, sub-scattering, structural colouration mechanisms. The main contribution in the proposed research will involve mathematical simplification of underlying Fourier optics by devising WDFs for heterogenous media to give physics-based models that are: (a) accurate, (b) fast, as well as (c) low on memory footprint, all at the same time. Resulting models and methods will be useful for virtual reality applications, bio-physical hypotheses validation and fabricating novel, bio-mimicking materials for engineering applications as well as visual artefact manifestations.

Bio:
Dr. Daljit Singh Dhillon is a research associate at Realistic Graphics and Imaging Group, Imperial College London (ICL), UK. His primary research interest lies in modelling material apperances and surface geometric phenomena. He has a keen interest in inter-disciplinary research involving visual computing, especially in material fabrication. His association with ICL began as a visiting researcher on a Swiss National Science Foundation (SNSF) fellowship for a post-doc position. He obtained his PhD in Computer Science from University of Bern, Switzerland. His PhD thesis ‘On Modeling and Simulating Reptile Skin Coloration’ was an inter-disciplinary research work in collaboration with biologists and physicists at University of Geneva, Switzerland. Apart from an academic research background in computer graphics and vision, he has eight years of industrial experience in software development, including research in video encoders and speaker verification using Hidden Markov Models.