Abstract: In the last decade, the study of superhydrophobic surfaces has become a hot-topic research area, attracting cross-disciplinary researchers from engineering, physics and applied mathematics. Apparent slip, and “friction reduction”, is achievable by manufacturing surfaces to be superhydrophobic, so that a liquid coolant, for example, flows by riding over structures containing gas pockets; this increases the flow rates for a given pressure drop, and can be beneficial in a wide range of applications in micro- and nano-fluidics through to heat transfer applications such as the cooling of microprocessors. The subject area is a rich source of challenging mixed boundary value problems that are usually attacked using sophisticated numerical methods. But it has also provided a fresh arena for the application of an armory of applied mathematical techniques often overlooked in today's undergraduate training of engineers and physicists (and even applied mathematicians). This talk will give an elementary, pedagogical introduction to a range of new mathematical results for quantifying slip over superhydrophobic surfaces. While illuminating a number of physical effects affecting the friction reducing properties of the surfaces, we also hope to showcase the perennial importance and vibrancy of the mathematical ideas.

Bio: Professor Darren Crowdy holds a Chair in Applied Mathematics at Imperial College London, where he has been on the faculty of the Department of Mathematics since 1999. Prof. Crowdy is currently an Established Career Fellow of the Engineering and Physical Sciences Research Council and a Wolfson Research Merit Fellow of the Royal Society. Prof. Crowdy has recently been a Visiting Professor at MIT, the California Institute of Technology, UC San Diego and the University of Kyoto, and is currently a Visiting Professor at the New Jersey Institute of Technology. Professor Crowdy's interests center on the application of methods of complex analysis to problems arising in the physical sciences, applied mathematics and mathematical physics. His special interests are in the field of fluid dynamics. Topical areas include vortex dynamics, free surface problems, ideal hydrodynamics, slow viscous (Stokes) flow, the theory of quadrature domains and applications, integrable systems theory, automorphic functions, potential theory and applications, techniques of conformal mapping and applications of algebraic geometry. He does much of his work within the Applied and Computational Complex Analysis group of the Department of Mathematics at Imperial College London, which is part of a wider network of UK-based universities, the ACCA-UK network, bringing together expertise in applied and computational complex analysis challenges with a view to fostering synergetic interaction and collaboration.

Host: Marc Hodes