



Timoshenko Medal

Professor Kenneth Johnson

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For his pioneering research in the area of contact and adhesive mechanics; his innovative experiments demonstrating the research; and his contributions to the understanding and practical solutions related to issues pertinent to the railroad industry.

Professor Kenneth Langstreth Johnson received his Bachelor's degree from Manchester University (now UMIST) in 1944, his Master's degree in 1948 and the doctoral degree in 1954. He started his career at Messers Rotol Ltd, working on vibrations in airplane propellers, but soon moved to academia. By the nineteen fifties he was appointed as a lecturer in the Department of Engineering at Cambridge University, and shortly after to a fellowship at Jesus College. Johnson's early work in Cambridge was concerned with the mechanics of rolling contact. This work led to an explanation of the phenomenon of 'shakedown' whereby, in repeated contact, a residual stress pattern develops which permits loads above the original plastic limit to be carried safely.

Over many years Professor Johnson has worked on the awkward problem of corrugation of railway lines. In an important experiment he showed how corrugation can develop spontaneously on discs rolled together at constant load and speed – and he accompanied this by a convincing theoretical analysis of the phenomenon. In 1971 Professor Johnson collaborated with Professor Tabor's group working on the behavior of windscreen wipers to produce the classic paper

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'Surface energy and the contact of elastic solids' – the 'JKR' theory of adhesion. With the blossoming of the Surface Force Apparatus (SFA) and the Atomic Force Microscope, it has become possible to measure inter-atomic forces directly and the JKR theory provides a good framework for interpreting these observations. With his collaborators he has studied the adhesion mechanics of the SFA, taking into account the surface geometry of mica flakes on a glue layer on a glass cylinder: he has produced an 'adhesion map' showing the different regimes, especially identifying when the action of the surface forces can be lumped together as a surface energy. He is also an authority on lubrication, and especially on the rheology of lubricating oils under the Hertzian pressures that they experience in gears and rolling element bearings. He has devised a qualitative test for distinguishing between solid-like and fluid-like behavior in lubricants, using spin and side-slip tests within a Hertzian contact.

Professor Johnson has been an exemplary research leader in all of these areas of tribology – he has written the best textbook on Contact Mechanics and has been much in demand both by

industry and as a keynote speaker at conferences. Professor Johnson is a Fellow of the Institution of Mechanical Engineers, Royal Society of London and the Royal Academy of Engineering. He is an Honorary Member of the American Society of Lubrication Engineers. He has received the Royal Society Medal (2003), 3M Award of the Adhesion Society (2002), Prager Medal for the Society of Engineering Science (1999), the Mayo D. Hershey Award from the ASME (1991), The IMechE Tribology Gold Medal (1985), the ASLE National Award (1983), and the Jacob Wallenberg Foundation Award. He has received the IMechE Best Paper Award five times.

The Timoshenko Medal was established in 1957 and is conferred in recognition of distinguished contributions to the field of applied mechanics. Instituted by the Applied Mechanics Division, it honors Stephen P. Timoshenko, world-renowned authority in the field, and it commemorates his contributions as author and teacher.