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Preface

Foreword to the special issue **Mechanics of Rubber: In Memory of Alan Gent**

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We are very pleased to be able to compile a Special Issue of the International Journal of Non-Linear Mechanics to honor the memory of Alan Gent, and we are delighted with the contributions to this Special Issue from his former collaborators, colleagues and those on whom he had an important influence. Alan Gent was a real gentleman and both rubber mechanics and the nonlinear elasticity communities owe him a huge debt for his contributions to the subjects, his deep insight, his generosity and his enthusiasm. We thank all the contributors to this Special Issue who have accepted enthusiastically to prepare their articles dedicated to the memory of Alan.

We begin with a short biographical sketch of Alan and follow this with a fairly complete list of his publications.

Alan Neville Gent

Alan N. Gent, who passed away on September 20, 2012, had a distinguished career in rubber and polymer engineering and science. In particular, his work had a major impact in the nonlinear mechanics of solids.

Alan N. Gent was born in 1927 in Leicester, England and was educated at the University of London, earning degrees in physics and mathematics. He received his Ph.D. in 1955 on the mechanics of deformation and fracture of rubber and plastics. At the age of 17 he worked as a research assistant at the John Bull Rubber Co., served in the British Army from 1947–1949 and then became a research physicist and later a principal physicist at the British Rubber Producers Research Association.

Gent joined the faculty of The University of Akron in 1961 as a professor of polymer physics in the Institute of Rubber Research. He became assistant director of the Institute just two years after joining the faculty and then was Dean of Graduate Studies and Research from 1978 until 1986. Gent returned to full time teaching and research from 1986 until his “unofficial” retirement in 1994. He served as consultant and scientific advisor to the Research Division of The Goodyear Tire & Rubber Company from 1964 to 2002.

Gent published more than 250 papers and book chapters on the mechanical properties of rubber and plastics, edited a book titled Engineering with Rubber, co-held two British patents and held one U.S. patent. He was frequently invited to address universities, corporations and professional society meetings and was visiting professor at Queen Mary College at the University of London, McGill University and the University of Minnesota. Gent served as Presidents of the High-Polymer Physics Division of the American Physical Society, The Society of Rheology and The Adhesion Society. In 1991 he was elected to the National Academy of Engineering.

Gent's extraordinary teaching and research career was recognized with numerous awards, some of which are the Bingham Medal of the Society of Rheology (1975), the Colwyn Medal of the Plastics and Rubber Institute (1978), Society of Plastics Engineers International Research Award (1980), George Stafford Whitby Distinguished Teaching Award of the Rubber Division of the American Chemical Society (1987), Charles Goodyear Medal of the Rubber Division of the American Chemical Society (1990), the Polymer Physics Prize of the American Physical Society(1996) and the NASA Public Service Medal (1988), the Tan Sri Dr. B.C. Sekhar Gold Medal for his influence on the world's rubber industry (2011) and the Inaugural Tire Technology International Lifetime Achievement Award (2012).

Two of Gent's contributions to nonlinear elasticity should be particularly highlighted. His paper with P.B. Lindley, “Internal rupture of bonded rubber cylinders in tension, Proceedings of the Royal Society of London, A 249 (1959) 195–205” motivated a large literature on the mechanics of cavitation in rubber. His paper

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"A new constitutive equation for rubber, Rubber Chemistry and Technology 69 (1996) 59–61" had a similar effect on the development of constitutive equations.

Alan Gent was a direct connection between the early and contemporary developments in rubber elasticity, having worked under R.S. Rivlin while at the British Rubber Producers Research Association and having known many of the prominent contributors to the subject. Gent enjoyed recalling his experiences and acquaintances and put a human face on the subject. He was respected, admired and a generous source of information and encouragement to his students and colleagues.

Main Publications by A. N. Gent

1. Measurement of dynamic properties of rubber, with W.P. Fletcher, Trans. Inst. Rubber Ind. 26 (1950) 45–63.
2. Apparatus for the measurement of the dynamic shear modulus and hysteresis of rubber at low frequencies, with W.P. Fletcher, J. Sci. Instrum. 29 (1952) 186–188.
3. Experiments on the mechanics of rubber I. Eversion of a tube, with R.S. Rivlin, Proc. Phys. Soc. B 65 (1952) 118–121.
4. Experiments on the mechanics of rubber II. The torsion, inflation and extension of a tube, with R.S. Rivlin, Proc. Phys. Soc. B 65 (1952) 487–501.
5. Experiments on the mechanics of rubber III. Small torsions of stretched prisms, with R.S. Rivlin, Proc. Phys. Soc. B 65 (1952) 645–648.
6. Torsion of prisms of rectangular cross section, Trans. Inst. Rubber Ind. 29 (1953) 173–174.
7. Non-linearity in the dynamic properties of vulcanized rubber compounds, with W.P. Fletcher, Trans. Inst. Rubber Ind. 29 (1953) 266–280.
8. Natural rubber compounds for intermittent low temperature service, with W.P. Fletcher and R.I. Wood, in: Proceedings of the Third Rubber Technology Conference, London, 1954, pp. 382–396.
9. Load-deflexion relations of rubber bush mountings, with J.E. Adkins, Brit. J. Appl. Phys. 5 (1954) 354–358.
10. Crystallization and the relaxation of stress in stretched natural rubber vulcanizates, Trans. Faraday Soc. 50 (1954) 521–533.
11. Crystallization in natural rubber II. The influence of impurities, Trans. Inst. Rubber Ind. 30 (1954) 139–143.
12. Crystallization in natural rubber III. Filled compounds, Trans. Inst. Rubber Ind. 30 (1954) 144–153.
13. Crystallization in natural rubber IV. Temperature dependence, J. Polym. Sci. 18 (1955) 321–334.
14. Dynamic shear properties of some rubberlike materials, with W.P. Fletcher, Br. J. Appl. Phys. 8 (1957) 194–201.
15. Internal flaws in bonded cylinders of soft vulcanized rubber subjected to tensile loads, with P.B. Lindley, Nature 180 (1957) 912–913.
16. Internal rupture of bonded rubber cylinders in tension, with P.B. Lindley, Proc. R. Soc. Lond. A 249 (1958) 195–205.
17. Crystallization in natural rubber V. Chemically modified rubber, J. Polym. Sci. 28 (1958) 257–264.
18. Forms for the stored (strain) energy function for vulcanized rubber, with A.G. Thomas, J. Polym. Sci. 28 (1958) 625–628.
19. On the relation between indentation hardness and Young's modulus, Trans. Inst. Rubber Ind. 34 (1958) 46–57.
20. Load-deflection relations and surface strain distributions for flat rubber pads, Rubber Chem. Technol. 31 (1958) 395–414.
21. The compression of bonded rubber blocks, with P.B. Lindley, Proc. Inst. Mech. Eng. 173 (1959) 111–122.
22. The deformation of foamed elastic materials, with A.G. Thomas, J. Appl. Polym. Sci. 1 (1959) 107–113.
23. Failure of foamed elastic materials, with A.G. Thomas, J. Appl. Polym. Sci. 2 (1959) 354–357.
24. Rubber bearings for bridges, Rubber J. Int. Plast. 137 (1959) 420-422.
25. The use of rubber in engineering, in: A.R. Payne, J.R. Scott (Eds.), Engineering Design with Rubber, Maclaren and Sons, London, 1960, pp. 213–224 (Chapter 9).
26. Preliminary design of rubber components, in: Proceedings of the Engineering Materials and Design Conference, London, 1960, pp. Cl–C7.
27. Developments in engineering applications of rubber, with P.B. Lindley and L. Mullins, in: Proceedings of Natural Rubber Research Conference, Kuala Lumpur, 1960, pp. 971–977.
28. Simple rotary dynamic testing machine, Br. J. Appl. Phys. 11 (1960) 165–166.
29. Theory of the parallel plate viscometer, Br. J. Appl. Phys. 11 (1960) 85–87.
30. The attack of ozone on stretched rubber vulcanizates I. The rate of cut growth, with M. Braden, J. Appl. Polym. Sci. 3 (1960) 90–99.
31. The attack of ozone on stretched rubber vulcanizates II. Conditions for cut growth, with M. Braden, J. Appl. Polym. Sci. 3 (1960) 100–106.
32. Ozone cracking, with M. Braden, Proc. Inst. Rubber Ind. 8 (1961) 88–97.
33. Stress relaxation, flow and recovery in vulcanized rubber, Phenomenons de Relaxation et de Fluage en Rheologie Non-Lineaire, CNRS Paris, 1961, pp. 241–252.
34. The mechanics of ozone cracking, with M. Braden, Kautsch. Gummi, 14 (1961) 157–165; reprinted in Rubber Chem. Technol. 35 (1962) 200–209.
35. The attack of ozone on stretched rubber vulcanizates III. Action of antiozonants, with M. Braden, J. Appl. Polym. Sci. 6 (1962) 449–455.
36. Relaxation processes in vulcanized rubber I. Relation between stress relaxation, creep, recovery and hysteresis, J. Appl. Polym. Sci. 6 (1962) 433–441.
37. Relaxation processes in vulcanized rubber II. Secondary relaxation due to network breakdown, J. Appl. Polym. Sci. 6 (1962) 442–448.
38. Relaxation processes in vulcanized rubber III. Relaxation at large strains and the effect of fillers, in: Proceedings of the Fourth Rubber Technology Conference, London, 1962, pp. 348–361.
39. Stress-temperature relations and crystallization in cross-linked polyethylene, with M.C. Morris, ACS Div. Polym. Chem. Pap. 3 (1962) 90–95.
40. Some chemical effects in fatigue cracking of vulcanized rubbers, J. Appl. Polym. Sci. 6 (1962) 497–502.
41. Viscoelastic behavior, with P. Mason, in: L. Bateman (Ed.), The Chemistry and Physics of Rubber-Like Substances, Maclaren and Sons, London, 1963, pp. 187–224 (Chapter 8).
42. Crystallization in natural rubber, with E.H. Andrews, in: L. Bateman (Ed.), The Chemistry and Physics of Rubber-Like Substances, Maclaren and Sons, London, 1963, pp. 225–247 (Chapter 9).
43. Ozone attack on rubbers, with E.H. Andrews, D. Barnard and M. Braden, in: L. Bateman (Ed.), The Chemistry and Physics of Rubber-Like Substances, Maclaren, London, 1963, pp. 329–354 (Chapter 12).