

ROYAL SOCIETY STATEMENT

Professor Geoffrey G Duffy FRSNZ

Professor Duffy's research career in chemical engineering spans almost four decades. His focus has been in fluid mechanics; specialising in the behaviour of asymmetric particles with particular emphasis on the flow of suspensions of natural wood pulp fibres. His major research directions have been investigating the unique suspension flow mechanisms, developing realistic and usable theoretical and empirical flow models in all regimes, and devising new measuring and instrumental methods and techniques. His research covers many areas of fibre separation and fibre processing technologies, open-channel flow, paper sheet structure and formation, paper drying, wood chip screening, and mechanical pulping. His contributions and insights have set a new platform for understanding structured flow systems, and in some pioneering areas there are no other papers in the literature.

He has developed many novel methods and procedures, and invented new processes. These applications include: the stable transport of large particulate solids, logs, and capsules (coal, wood chips, tree logs) in fibre suspensions so they do not settle out; the elimination of fouling deposits with simultaneous augmentation of heat transfer in heat exchangers using fibres; the use of heat transfer measurements in suspension flow to determine/predict fibre and paper properties; the application of simple additives to de-flocculate fibres bundles and improve screening efficiency; capitalising on the visco-elastic behaviour of fibre suspensions to both characterise fibres and reduce pumping power; and several other methods applied to industrial pulp washing, screening, pulp thickening, pumping and infrared heating/drying.

His simple method of injecting air bubbles at the pipe wall onto surface of flowing suspensions to reduce friction and power demand by over 40% is used worldwide. He invented a new fibre-recovery screen that was developed by a screen manufacturer and installed in a pulp mill in Germany within a year of its inception. Another very significant contribution from Geoff and his earlier research team was the development of procedures for designing industrial pipelines to transport wood pulp fibre suspensions in pulp and paper mills. These methods have been successfully used to design some of the biggest pulp mill piping systems in the world with documented savings of many millions of dollars. The design procedures are used worldwide, and endorsed and published by The Hydraulics Institute USA, TAPPI USA, Goulds Pumps Inc. USA, Scanpump AB Sweden, and many international consulting companies.

He has published widely in top journals and presented many conference papers and invited keynote addresses. He has 85 journal publications (23% sole authored) and 135 conference papers (36% sole authored), and his inventive ability has been demonstrated by 10 assigned patents. He has consulted widely worldwide and is still very active in Europe, USA, and Australasia.

His achievements have been recognised nationally and internationally; by his peers, by the university, by the profession, and by the pulp and paper fraternity worldwide. His research following his PhD was rewarded with the earned Doctor of Engineering DEng degree in 1988, where the emphasis was on innovation. The university recognised his attainments when he was awarded a Personal Chair also in 1988. He was elected a Fellow of the Royal Society of New Zealand in 1988 (the first chemical engineer) having been a recipient of the RSNZ E. R. Cooper Medal in 1971. The Australasian pulp and paper industry recognised Geoff's important contributions with their top award, the L R Benjamin silver medal. In the international arena, the Technical Association of the Pulp and Paper Industry TAPPI USA made Geoff a Fellow, being only the second Fellow in the southern hemisphere and the only researcher. His accomplishments were also recognised and rewarded by the engineering profession when he was elected a Fellow of IPENZ as a non-member. The wider chemical engineering community in Australasia also honoured him with one of their top chemical engineering awards, the ESSO Award. His consistent, long-term, valuable research contributions were recognised more recently when he was awarded the NZ Government's Science and Technology Silver medal in 2003. His teaching competence matches his research achievements as he was the first full-professor at Auckland to receive the Universities top teaching medal award.

Geoff is a leader in the field. He was invited to be the inaugural Director of a Research Organisation PAPRO NZ and later was head-hunted for two other research institute directorships (in Australia and Sweden). He has been Head of Department, a Director of a research consulting company, Associate Dean Research of the Engineering School, and called to be an expert-witness in patent law Court cases in the USA. His extensive career and leadership in several fundamental and applied research areas validate his standing and hence his nomination.