

## **SUMMARY OF ACHIEVEMENTS:**

**PROFESSOR GEOFFREY G DUFFY**  
**DEng, PhD, BSc, ASTC Dip, FRS NZ, FIChemE, CEng**  
**Professor of Chemical Engineering**  
**The University of Auckland**

## **RECOGNITIONS, HONOURS AND AWARDS**

1. **Personal Chair 1988:** A Personal Chair (a professorship) in Chemical Engineering is the highest acknowledgement that the University of Auckland can give. It is based on his international standing as a scholar and researcher (he was only the second in the School of Engineering up to 1988). It is assessed by a local panel of professors and then submitted to independent referees and researchers in the field of pulp and paper science and engineering from Scandinavia, Europe and USA/Canada.
2. **Doctor of Engineering degree – DEng 1988:** Geoff was the first in both New Zealand and Australia to receive the higher earned degree, DEng from a university (equivalent to a DSc) [awarded primarily for his innovations, inventions and contributions to the field as judged independently by experts in the field from around the world]. [Only one other earned DEng has since been awarded].
3. **Tappi Fellow 1990:** Elected a Fellow of the Technical Association of the Pulp and Paper Industry TAPPI in the USA. [The second in the Southern Hemisphere].
4. **Fellow of the Royal Society of New Zealand FRS NZ 1987:** Dr Duffy was the first *Chemical Engineer* in New Zealand to be awarded this honour back in 1987. This is the highest accolade in New Zealand for research scientists and engineers, is peer reviewed by overseas experts in the field, and awarded by the Royal Society Academy Board with cross reference to all Fellows.
5. **Appita L R Benjamin Silver Medal 1982:** The highest award from the Australasian pulp and paper industry for his pioneering and innovative work in fibre suspension rheology and fibre processing (youngest recipient at the time).
6. **E R Cooper Royal Society Medal for outstanding contributions 1971:** This is awarded every two years for the "best single piece of research in physics and engineering in New Zealand" (Joint award with his student then Dr Klaus Moller).
7. **Distinguished Teacher of the Year Award and University Medal 1995:** Geoff was the first full-professor in the whole of the University of Auckland to receive the distinguished teaching award. (He has also received 5 annual Merit Awards in Engineering and 5 in the "top Twenty").
8. **Fellow-elect of the Institution of Engineers New Zealand FIPENZ 1991:** Duffy was elected a Fellow of IPENZ in 1991 *without* being a member of IPENZ and was one of four so elected as an honour by the Board of the Institution at the time.
9. **Esso Award Chemeca 2003:** Presented by Esso Petroleum as a top award of the Australasian Institution of Chemical Engineers and Institute of Engineers Australia for long term contributions to the field of chemical engineering in Australasia.
10. **New Zealand Science and Technology Silver Medal 2003:** New Zealand Government to research award presented by The Royal Society of New Zealand on its behalf for; "an outstanding specific contribution to the promotion and advancement of technology over an extended period".
11. **Fellow of the Teaching Academy School of Engineering 2005:** Elected 1 of four initially for consistent top awards in teaching in engineering.

## **RESEARCH**

1. **Publications:** 292 Total Publications: 230 Published journal articles and conference papers/reports. Journals; 85 (20 sole authored): Conference Papers; 135 (49 sole authored): Patents: 10 (8 patents pending): Reports; 62 special reports for the industry
2. **Patents:** Professor Duffy has 10 granted patents, 7 of which he is the sole inventor.
3. **Publications in topline peer-reviewed journals:** Duffy has published widely in top international peer-reviewed journals including: J. Pulp and Paper Sc., Nordic J., Svensk Papperstidning, Tappi J., Canadian J.

Chem. Eng., A.I.Chem Eng. J., Appita J., Chem. Eng J., Heat Transfer Eng., J. Applied Thermal Eng., Int. J. Heat Transfer Eng., Int. J. Energy Research, Wochenblatt für Papierfabrikation, Chem Eng. Communications, and Das Papier.

4. **Single-authored papers:** Geoff has 32% of his total journal and conference publications as a single author (25% as sole author for his published refereed journal articles) showing original and independent research standing.

#### **DETAILS OF RELEVANT CONTRIBUTIONS TO SCIENCE AND TECHNOLOGY IN NEW ZEALAND AND OVERSEAS (AUSTRALIA, USA, EUROPE AND SCANDINAVIA)**

1. **Internationally accepted design procedures:** Part of Professor Duffy's research has resulted in the development of industrial pipeline design procedures which were firstly applied in pulp and paper mills in New Zealand. This led to their acceptance worldwide. The Technical Association of the Pulp and Paper Industry TAPPI USA adopted the procedures officially as their industrially recommended methods for designing piping systems for transporting wood pulp fibre suspensions. These design techniques were adopted and published by the Hydraulics Institute of the USA. Goulds Pumps Inc USA also adopted them after joint consultation with industry-Goulds-Duffy and have a design section in their pump manual based on these developments. His computer software package has been purchased and applied by many of the big design consulting companies in the world. He was the main adviser to the consultants on the then longest pulp pipeline in the world 8.6km at Braviken, Norköpping in Sweden in 1977 that operated well for 18 years before the mill was closed.
2. **Innovations and inventions:** Professor Duffy has developed several innovative devices and methods, some of which have opened new possibilities of solving industrial problems and some of which are operating in pulp and paper mills throughout the world. These include:
  - (a) Air injection onto the inner surface of a pipe to 'lubricate' the plug of fibre suspension at high concentration to reduce pipe friction by more than 40%. This has been applied widely to reduce pump power requirements.
  - (b) Use torque measurements from a variable speed motor drive connected to a pump as a fibre concentration meter for determining of flowing wood pulp fibre suspensions
  - (c) Using wood pulp fibres to mitigate fouling in heat exchangers as they act as 'micro-mixers' to reduce the foulant concentration gradient
  - (d) Using heat transfer coefficient and/or pressure drop measurements to relate to fibre characteristics and quality, and to predict fibre and paper properties
  - (e) Using wood pulp fibres to support and transport solid objects and particles (such as coal, wood chips, tree logs and capsules)
  - (f) Using injected steam to displace the liquor and wash pads of wood pulp fibres as well as increase fibre concentration (simultaneous washing and pressing)
  - (g) Using dimples on tubes to increase heat transfer coefficient without greatly increasing pipe friction loss (world first, acknowledged in 'New Scientist')
  - (h) Using the metal between the holes and slots in a screen to separate fibres by a new technique called fibre stapling
  - (i) Using a viscous fluid to reduce flocculation, mobilise fibres, and increase fibre recovery in pressure screening in pulp processing
  - (j) High-speed rotating disc to separate and fractionate wood pulp fibre suspensions as a 'screenless screen'. This was the first non-barrier type screening method.
  - (k) Use of non steady-state flows to measure and characterise fibre flocculation and to reduced pumping power (flow hysteresis measurements)
  - (l) Use of a rotary tube to mobilise fibre suspensions in a pump or at a tank-pump inlet to reduce the frictional resistance to flow and ease pumping problems at higher fibre concentrations
  - (m) Application of newly designed elongation slot in industrial screens to increase fibre recovery and total throughput in the pressure screening of recycled fibres.
3. **Expert witness in USA Courts:** Duffy has been the sole expert witness for two large companies in the USA in two patent law suit cases, namely, Marcal Paper Company in New Jersey, and Goulds Pumps Inc., New York. The later case was a multimillion dollar law suit with only one expert representing each company in court. Both cases were won mainly based on the technical expertise, research knowledge, and the previous research achievements of Dr Duffy.

4. **Consulting worldwide by invitation:** Geoff has been a consultant to some of the biggest companies in the world associated with the pulp and paper industry showing his abilities, expertise and recognition of his talents. These include:
  - (a) Goulds Pumps Incorporated, USA.
  - (b) Scanpump AB, Sweden
  - (c) Kvaerner Pulping, Sweden
  - (d) Nystrom, Kobayashi and Lee, Canada
  - (e) Procter and Gamble, USA
  - (f) Du Pont USA
  - (g) Weyerhaeuser Paper Company, USA
  - (h) Keystone Valve International, USA
  - (i) Marsden Incorporated USA
  - (j) Holmens Bruk, Sweden
  - (k) Ahlstrom Pumps, Finland
  - (l) Niro Atomizer, Denmark
  - (m) Marcal Paper, USA
  - (n) Beloit Corporation, USA
  - (o) Kvaerner Pulping, Norway
  - (p) Norkse Skog, Norway
  - (q) Voith Paper GmbH, Germany
  - (r) Beca-Simons, Canada
  - (s) International Paper Company, USA
  - (t) And several companies in Australia and New Zealand including: NZ Forest Products Ltd, Caxton Paper Mills Ltd, Tasman Pulp and Paper Ltd, Winstone Pulp Mills, Carter Holt Harvey Ltd, Oji Paper Company, Norske Skog NZ Ltd, Australian Paper Manufacturers Ltd, AMCOR Australia Ltd, Visy Board Australia Ltd, Australian Newsprint Ltd, Winstone Wallboards Ltd, Fletcher Challenge Ltd, Fletcher Duroid Ltd.

## **INTERNATIONAL**

1. **Institute Director by invitation:** Professor Geoff Duffy was selected as the inaugural Director of the Pulp and Paper Research Organisation of New Zealand PAPRO NZ (1986-1989) following a worldwide search for a suitable applicant to lead the new institution. He jointly held his University position. At a later time he was 'headhunted' for the Directorship of the Australian Pulp and Paper Institute, APPI, at Monash University Australia, and more recently as Vice-President of the prestigious Swedish Forest Products Research Institute STFI in Stockholm Sweden, which is undoubtedly one of the top research centres of its kind in the world.
2. **Invited lectures and plenary addresses**
  1. **Plenary Lecture** at the 7<sup>th</sup> National Chemical Engineering Conference in Johannesburg South Africa, August, 1994 on lateral thinking and innovation following Nelson Mandela's request for internationally acclaimed selected speakers.
  2. **Invited Keynote speaker** at the Nordic Rheology Annual Conference in Stockholm in June 2006.
  3. **Invited Keynote speaker** at the Swedish Ekman Days annual symposium in Stockholm in 1988.
  4. **Invited Keynote speaker** by the Swedish company Scanpump AB Gothenburg to be the keynote speaker at the 1988 European opening of their new facilities.
  5. **Several other keynote addresses** in the USA, Scandinavia (STFI, ABS Scanpump AB, Norske Skog AS), New Zealand and Australia.
3. **Invitations to serve on international committees:**
  - (a) **BHRA Hydrotransport Conferences:**  
Dr Duffy presented a revolutionary new hydraulic transport system in 1984 at the British Hydromechanics Conference BHR Hydrotransport 9 using wood pulp fibres as a suspending medium. Since then has been invited to serve on the Committee for subsequent BHRA Conferences, Hydrotransport 10 to 17. He is still on that Committee.
  - (b) **International Conferences of the Transport and Sedimentation of Solid Particles:** Duffy was invited to be on the Conference committee for two conferences in Poland and the last one in Prague. He is still on the committee for his recognised work and application and acclaim in applied fluid mechanics in the industry.
  - (c) **Pacific Rim Conferences on Rheology:** Duffy was invited to be on the International Advisory Board of the 2<sup>nd</sup> (Australia) and 3<sup>rd</sup> (Canada) Conferences on Rheology.
  - (d) **Member of the Board:** International Freight Pipeline Committee USA 1991-95 by invitation and then by election.

(Updated November 2006)