

RESUME

R.P. CHHABRA

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PERSONAL:

Date of Birth: 3rd January, 1953

EDUCATION:

Univ. of Roorkee, Roorkee, India
B.E.(Chemical Engineering) 1974
First Class with Honours

Indian Institute of Science, Bangalore
M.E. (Chemical Engineering) 1976
First Class with Distinction

Monash University, Clayton, Australia
Ph.D. (Chemical Engineering) - 1980

AWARDS:

J N Gupta & Smt M D Gupta Chair Professor
(Since September 2009)

Fellow, National Academy of Sciences, India
(Elected in 2010)

Fellow, Indian National Academy of Engineering
(Elected in 2000)

P.D. Verma Memorial Lecture, Department of Mathematics
University of Rajasthan, Jaipur (2003)

Professor Gopal Tripathi Memorial University Lecture,
BHU, Varanasi (2008)

Herdillia Award of the Indian Institute of Chemical
Engineers for Excellence in Basic Research in Chemical
Engineering - 1996

Amar Dye-Chem Award of the Indian Institute of Chemical
Engineers for Excellence in Research and Development for a
Chemical Engineer below the age of 35 years - 1988

M.H. Shukla Prize for Best Paper, CHEMCON 2001

Best Poster Award, CHEMCON 2001

Gold Medal for the best design project - 1974

University of Roorkee Award for the Second best student - 1974

UNIVERSITY APPOINTMENTS:

Mar., 1991 - present	Indian Institute of Technology, Kanpur Professor (Department Chair 1/2000- 12/2002)
Jan., 1994 - Dec., 1995	Univ. of New South Wales, Sydney Senior Lecturer
Oct., 1984 - Feb., 1991	Indian Institute of Technology, Kanpur Assistant Professor
June - Sept., 1984	University College of Swansea, Swansea Lecturer
Feb., 1981-May, 1984	University College of Swansea, Swansea Senior Research Associate
July-Dec., 1980	Monash University Clayton Senior Research Fellow
Feb.-June, 1980	University of Sydney, Sydney Senior Research Associate
Aug.1976-Jan.1980	Monash University, Clayton Part-time Tutor and Laboratory Instructor

SHORT TERM AND VISITING APPOINTMENTS

May- July, 2011	PAGORA, Grenoble INP, Grenoble Visiting Professor
July – Dec, 2007	Applied Mechanics Division, IFP, Rueil Malmaison (Paris) Visiting Scientist
May-June, 2007 May-July, 2008 May-July, 2010	University of Western Ontario, London Visiting Professor
Jan – May, 2007	Purdue University, West Lafayette, IN Visiting Professor
May-June, 2006	Monash University, Melbourne, Australia Visiting Academic
May-July, 2005	LGPTA – INRA, Lille (France) Visiting Scientist

May-July, 2004	Kobe University, Kobe Visiting Professor
May-July, 2002	Domaine Universitaire EFPG-INPG, Grenoble Visiting Professor
May – Jul., 1999 July, 2000, 2001	Cape Technikon, Cape Town Visiting Professor
Apr – Jul, 1998 Nov - Dec, 1998 June, 2000 May-July, 2003 May – July, 2009	LGP, Universite de Nantes, St . Nazaire Visiting Professor
May - Aug, 1991 May-June, 1992, 1995 & 2001	Clarkson University, Potsdam, NY Visiting Professor
May-June, 1990 July-Nov., 1992	Ecole Polytechnique of Montreal, Montreal Visiting Professor
May-July, 1988	University of Windsor, Windsor, ON Visiting Professor
Aug.-Dec., 1987	SUNY at Buffalo, Buffalo, NY Visiting Assistant Professor
May-July, 1987 (Also in 1986)	Monash University, Clayton, Australia Research Associate

COURSES TAUGHT:

Fluid Mechanics and Rate Processes
(Core Course)
Engineering Applications of Rheology*
Heat Transfer Operations
Transport Phenomena*
Mass Transfer and Stagewise Processes
Mechanics of Non-Newtonian Fluids*
Chemical Process Design
Principles of Polymer Processing*
Separation Processes
Fluid Mechanics
Particle Science and Technology
Introduction to Chemical Engineering
Research Methods and Skills
Heat and Mass Transfer
(*Graduate Level)

OUTREACH ACTIVITIES:

- Invited Lecturer, “*The Flow of Non-Newtonian Slurries and Sludge in Pipes*”, Cape Technikon, Cape Town, 1999, 2000, 2001, 2003, 2004 & 2006.
- Invited Lecturer, “*A short course on rheology*”, Organised by the Australian Soc. Rheology, Melbourne, 1994.
- Invited to give lectures on two phase gas/liquid flow in the Institute of Chemical Engineering of the Technical University of Lodz, Poland (May, 1984)
- Exchange Visitor under auspices of the British Council in the University College of Swansea, Swansea (August, 1987; July 1990; May, 1991)
- Have consulted for Unilever Research Laboratory (U.K.), English Clays Lovering Pochin & Co., Ltd. (U.K.), an oil company in Norway, and the Saraswati Sugar Mills, Yamuna Nagar, India, on a number of occasions.
- UGC National Lecturer, Dept of Chemical Engineering, Indian Institute of Science, Bangalore (Nov. 2002).
- Invited to conduct a workshop on *Making of an Engineer: Problem solving skills and professional ethics*, IIT Gandhinagar (August 2010, 2011).

PROFESSIONAL ACTIVITIES:

- Member, Editorial Board, **J. Non-Newtonian Fluid Mech.** (Elsevier, Amsterdam) (2007 onwards)
- Regional Editor, **Heat Transfer-Asian Research**, Wiley, New York (2011 onwards)
- Member, Editorial Board, **Industrial Crops & Products** (Elsevier, Amsterdam) (2011 onwards)
- Member, Editorial Board, **Journal of Mining & Metallurgy** (ISSN:1450-5339) (2010 onwards)
- Member, Editorial Board, **Indian Journal of Chemical Technology** (2008 onwards).
- Member, Editorial Advisory Board, **Int. J. Eng. Fluid Mech.** (Gulf, Houston.) (1987-1992).
- Member, International Advisory Committee, **HYDROTRANSPORT** Conferences organised by BHR Group, Cranfield, UK.
- **Reviewer** for AIChE Journal; Chem. Eng. Res. Des.; J. Applied Phys.; Ind. Eng. Chem. Res.; J. Non-Newt. Fluid Mech.; Chem. Eng. Communications; Can. J. Chem. Eng.; Biotech. Bioeng. ; Int. J. Multiphase Flow; Chem. Eng. Sci.; Int. J. Mineral Proc. ; J. Rheology ; Environmental Sci. & Technol. ; Chem. Eng. & Process.; Indian J. Technology ; Indian Chem. Engineer. ; Proc. Acad. Sci. (India); Rheol. Acta ; Dev. Chem. Eng. ; J. Thermo-Physics & Heat Transfer ; J. Colloid & Interface Sci.; J. Appl. Mech. (ASME) ; Chem. Eng. J.; Int. J. Heat & Mass Transfer ; Powder Technology; J. Fluids Eng. (ASME) ; Int. J. of Thermal Sciences; Applied Rheology; Int. Journal of Thermo-physics; Journal of Applied Polymer Science ; Journal of Heat Transfer (ASME); J. Computations & Applied Math.; Physics of Fluids; SPE Journal; Langmuir; Exp. Thermal & Fluid Science; Chem. Phys. Letters; J. Food Engineering; Computers & Fluids; Polymer Engineering & Science, Microfluidics & Nanodevices; Proceedings of the Royal Society (Part A); Ocean Engineering; Industrial Crops & Products; Australia-Korea J of Rheology; Heat Transfer Engineering; Int. J of Chemical Engineering; Int. J of Chemical Reaction Engineering; Construction & building Materials; Chemical Engineering & Technology; International Journal of Mining & Mineral Engineering; Experimental Heat Transfer; Journal of Fluid Mechanics; Environmental Technology; Canadian Journal of Physics; Brazilian Journal of Chemical Engineering; Communications in Non-Linear Science & Numerical Simulations; Progress in Computational Fluid Dynamics.
- Book proposals for CRC Press, Boca Raton, FL; Butterworth-Heinemann, Oxford (U.K.) and New Age International, New Delhi.
- Reviewer for **Applied Mechanics Reviews** (ASME publication) (1979-83).
- External Examiner for M.Sc. and Ph.D. theses of Monash University, Clayton; University of Sydney, Sydney; The University of Adelaide, Adelaide; Central Queensland University, Rockhampton; RMIT University, Melbourne; The University of Melbourne, Melbourne; Curtin University of Technology,

Perth; Sultan Qaboos University, Muscat, Oman; Cape Technikon, Cape Town; Cape Peninsula University of Technology, Capetown; I.I.T. Kharagpur ; I.I.T. Madras; I.I.T. Mumbai; I.I.T. New Delhi; Banaras Hindu University, Varanasi; University of Pune, Pune; Jadavpur University, Kolkata; UICT, Mumbai; Indian Institute of Science, Bangalore; Universite de Nantes, Nantes; Grenoble INP, Grenoble.

MEMBERSHIP OF PROFESSIONAL BODIES

- Member, Indian Institute of Chemical Engineers, Kolkata
- Member, Alumni Association, University of Roorkee (Now Indian Institute of Technology, Roorkee)
- Member, Alumni Association, Indian Institute of Science, Bangalore.

RESEARCH ACTIVITIES

Current Interests

- Hydrodynamics of non-Newtonian fluid-particle systems including bubbles, drops, particles and fluidization.
- Multiphase (Gas/Liquid) flow in pipes and in packed beds.
- Interaction between nonlinear properties of fluids and shapes of particles.
- Modelling of non-Newtonian fluid flow in fibrous media

Thesis Supervision

Ph.D.

1. Simulation of Newtonian and non-Newtonian Fluid Flow in Multi-particle Assemblages (1991) (A.K. Jaiswal).
2. Flow over and Heat Transfer to Power-Law Fluids Across a Square Cylinder in Steady Regime: A Numerical Study (2007) (A. K. Dhiman).
3. A Numerical Study of Power Law Fluid Flow and Heat Transfer over a circular cylinder (2007) (Ram Prakash).
4. Flow and Heat/Mass Transfer from a Rigid Sphere and a Spherical Bubble to Power-Law Fluids: A Numerical Study (2007) (Sunil Dhole).
5. Single and Multiple Fluid Spheres in Power-law Liquids: Drag and Mass Transfer Phenomena (2008) (Nanda Kishore).
6. Momentum and heat transfer characteristics of a square cylinder in power-law fluids in laminar vortex shedding regime (2010) (Akhilesh K Sahu).

M.Tech.

1. Non-Newtonian fluid particle systems (1986) (S. Gummalam)
2. Transport in liquid metals (1986) (A.K. Roy)
3. Flow of liquids through a screen (1987) (S. Das)
4. Behaviour of non-Newtonian emulsions (1988) (P.S. Sastry)
5. Non-Newtonian Fluid Flow in Fixed and fluidized beds (1990) (B.K. Srinivas)
6. A FEM study of bubble motion in Newtonian and non-Newtonian media (1990) (M. Manjunath)
7. Settling of Cylinders and glass bead suspensions in Newtonian and non-Newtonian media (1990) (A. Unnikrishnan)

8. Non-Newtonian fluid particle systems: Effect of particle shape (1991) (M.K. Sharma)
9. Flow of non-Newtonian fluid through packed beds: Effects of Particle size distribution and confining walls (1992) (P.T. Rao)
10. Flow behaviour of non-Newtonian fluids in complex geometries (1992) (P.V. Balaramakrishna).
11. Drag on Non-Spherical Particles in Non-Newtonian Fluids (1993) (G. Venu Madhav).
12. Two Phase Gas-Non-Newtonian Liquid Upward Flow in Packed Beds (1993) (K.V. Srinivas).
13. Numerical simulation of fluid and rigid particle motion in viscous media (1993) (A. Tripathi).
14. A Numerical Study of Newtonian Fluid Flow Over a Disk (1998) (B.Munshi).
15. Steady incompressible fluid flow over a bundle of cylinders : A numerical study (1998) (Satheesh V.K.)
16. Power law fluid flow past an assemblage of circular cylinders (1999) (B.N. Dhotkar)
17. A numerical study of steady power law fluid flow across an assemblage of cylinders (1999) (M.Vijaysri)
18. Cross flow of Non-Newtonian fluids over a bundle of rods and in a bed of screens (2000) (D.V.N. Prasad)
19. Drag and Wall effects on spherical and non-spherical particles (2000) (K. Rami)
20. Non-Newtonian Fluid Flow over a collection of cylinders (2000) (Shibu S.)
21. Power Law Fluid Flow over a square cylinder (2000) (Gibu George)
22. Two Phase Gas/Liquid Flow in Helical Coils (2000) (S.V.S.R. Krishna Bandaru)
23. Temperature dependence of self diffusion in liquid metals (2001) (C. Jayaram)
24. Transient analysis of a gas manifold system (2001) (V. Parolia)
25. Momentum and thermal boundary layers of a power law fluid over a thin cylinder (2001) (M. Agarwal)
26. Drag on cylinders in non-Newtonian fluids (2001) (C.K. Jena)
27. Convective heat transfer between a bundle of cylinders and a Newtonian fluid (2001) (V.K. Mandhani)
28. Blow down of pipelines carrying flashing liquids (2002) (Amit Vaish)
29. Convective heat transfer between a bundle of circular cylinders and a power law fluid (2002) (N. Mangadoddy).
30. Flow of two phase air-polymer solution mixtures over tube bundles (2002) (T.V. Malleswara Rao).
31. Flow of power-law liquid in beds of spherical particles (2002) (Sunil Dhole).
32. Heat transfer in packed beds with power-law fluids (2002) (Rupali Shukla).
33. Flow and heat transfer to power law liquids from a square cylinder (2003) (B. Paliwal)
34. Flow and heat transfer to non-Newtonian liquids from a square cylinder (2003) (A.K. Gupta)
35. A numerical study of flow of Newtonian and non-Newtonian fluids past a square cylinder in a rectangular channel (2003) (Mukesh Gupta).
36. Computational Fluid Dynamics Study of Flow Past a Circular Cylinder in a Plane Channel: Wall Effects (2003) (J.P. Chakraborty).
37. CFD Modelling of Two-Dimensional Flows of Newtonian and Power Law Fluids (2004) (S. Nitin)
38. Drag on Conical Particles in Newtonian and Power Law Fluids (2004) (A. Borah)
39. Flow over a Single and Multiple Spheres: Drag and Heat Transfer (2004) (A. Maheshwari)
40. Drag on Non-Spherical Solid Particles in Power Law Fluids (2004) (P. Rajitha)
41. Mass transfer from a swarm of bubbles to power law liquids (2005) (A. Basak)
42. Power law liquid – solid mass transfer in fluidized beds (R. S. Ghoshbag) (2005)
43. Mixed convection heat transfer in power law fluids from a square cylinder (N. Anjaiah) (2005)
44. Flow of liquids through screens and filters (S. S. Chandrawanshi) (2006)
45. Flow past circular and elliptic cylinders: A numerical study (P. Sivakumar) (2006)
46. Flow of liquids in tube bundles (U. K. Singh) (2006)
47. Flow of liquids in mini-channels (C. Ramesh) (2007).
48. Flow over two circular cylinders in a tandem configuration: Drag and heat transfer (R. C. Patil) (2007).
49. Momentum and heat transfer from a cylinder to Power-law fluids in the unsteady flow regime) (V. K. Patnana) (2008).
50. Mixed convection from a cylinder to power law liquids (T. Srinivas) (2008).
51. Flow over and heat transfer from a semi-circular cylinder (A. Gode) (2009).
52. Effect of confinement on unsteady flow over a cylinder (M. Koteswara Rao) (2009).
53. Flow over and heat transfer from bluff bodies (P. Koteswara Rao) (2010).
54. Bluff bodies in power-law fluids: Momentum and heat transfer (A. Prhashanna) (2010).
55. Flow and heat transfer from a single and twin cylinders in power-law fluids (S. K. Panda) (2010).

56. Effect of bluff body shape on free convection in power-law fluids (C. Sasmal) (2011).

LIST OF PUBLICATIONS

R. P. CHHABRA

(A) BOOKS

1. R. P. Chhabra and D. De Kee, (Eds.) *Transport Processes in Bubbles, Drops and Particles*, Hemisphere, New York (1991) (ISBN: 0 89116 999 7).
2. R. P. Chhabra, *Bubbles, Drops, and Particles in Non-Newtonian Fluids*, CRC Press, Boca Raton, FL (1993) (ISBN: 0 8493 6718 2). Reprinted, 1994. **Second edition, 2006**. CRC Press, Boca Raton, FL (ISBN: 0 8247 2329 5) pp 800.
3. P. J. Carreau, D. De Kee and R. P. Chhabra, *Rheology of Polymeric Systems: Principles and Applications*, Hanser, Munich (1997) (ISBN: 1 56990 218 6).
4. D. Siginer, D. De Kee and R. P. Chhabra (Eds.), *Advances in the Flow and Rheology of Non-Newtonian Fluids*, Parts A & B, Elsevier, Amsterdam (1999) (ISBN : 0 44482 679 3).
5. R. P. Chhabra and J.F.Richardson, *Non-Newtonian Flow in the Process Industries: Fundamentals and Engineering Applications*, Butterworth-Heinemann, Oxford (1999) (ISBN: 0 7506 3770 6).
6. D. De Kee and R. P. Chhabra (Eds.) *Transport Processes in Bubbles, Drops and Particles*, Volume 2, Taylor & Francis, New York, (2002) (ISBN: 1 56032 9068).
7. R. P. Chhabra and J. F. Richardson, *Non-Newtonian Flow and Applied Rheology*, IInd edition, Butterworth-Heinemann, Oxford, U. K. (2008) (ISBN: 978-0-7508-8532-0) pp.536.

(B) OTHER BOOK AUTHORIZING ACTIVITIES

1. SI adaptation of the book: W S Janna: *Design of Fluid Thermal Systems*, IIIrd edition, CENGAGE, Stamford, CT (2010).

(C) CHAPTERS IN BOOKS

1. R. P. Chhabra, Steady non-Newtonian flow about a rigid sphere, *Encyclopedia of Fluid Mechanics*, Vol.1: Edited by N.P. Cheremisinoff, Gulf, Houston (USA) pp.983-1023 (1986).
2. R.P. Chhabra and J.F. Richardson, Co-current horizontal and vertical upwards flow of gas and non-Newtonian Liquid, *Encyclopedia of Fluid Mechanics*, Vol.III Edited by N.P. Cheremisinoff, Gulf, Houston (USA) pp.563-609 (1986).
3. R.P. Chhabra, Hydrodynamics of bubbles and drops in rheologically complex liquids, *Encyclopedia of Fluid Mechanics*, Vol.VII Edited by N.P. Cheremisinoff, Gulf, Houston (USA) pp.253-286 (1988).
4. R.P. Chhabra and P.H.T. Uhlherr, Static equilibrium and motion of spheres in viscoplastic liquids, *Encyclopedia of Fluid Mechanics*, Vol.VII: Edited by N.P. Cheremisinoff, Gulf, Houston (USA) pp.611-633 (1988).

5. R.P. Chhabra, Hydraulic transport of solids in horizontal pipes, *Civil Engineering Practice*, Vol.II Edited by P.N. Cheremisinoff, N.P. Cheremisinoff and S.L. Cheng., Technomic, Lancaster, PA (USA), pp. 251-295 (1988).
6. R.P. Chhabra, Diffusion in liquid metal systems: A predictive approach, *Handbook of Ceramics and Composites*, Vol.I: Edited by N.P. Cheremisinoff, Marcel Dekker, New York (USA) 601-627 (1990).
7. R.P. Chhabra, Transport properties of liquid metals, *CRC Handbook of Chemistry and Physics*, E-12; F51-53, 70th Edition CRC, Boca Raton, FL (1989/90) and subsequent editions.
8. R.P. Chhabra, Liquid Mixing *Chemical Engineering*, Vol.1: J.M. Coulson and J.F. Richardson, 225-260, IVth edition, Pergamon, Oxford (1990) and subsequent editions.
9. R.P. Chhabra, Viscosity of Liquid Metals, *CRC Handbook of Chemistry and Physics*, E-12, F51-55, 71st edition CRC, Boca Raton, FL (1990/91) and subsequent editions..
10. R.P. Chhabra and D. DeKee, Fluid particles in rheologically complex media, *Transport Processes in Bubbles, Drops and Particles*, Hemisphere, New York, (1991) Chapter 2.
11. R.P. Chhabra, Fluid flow, heat and mass transfer in non-Newtonian fluids: Multiphase systems, *Advances in Heat Transfer*, 23, 187-278 (1993).
12. R.P. Chhabra, Transport processes in particulate systems with non-Newtonian fluids, *Advances in Transport Processes*, 9, 501-577, Elsevier, Amsterdam (1993).
13. U.K. Ghosh, S.N. Upadhyay and R.P. Chhabra, Heat and mass transfer from immersed bodies to non-Newtonian Fluids, *Advances in Heat Transfer*, 25, 251-319 (1994).
14. R.P. Chhabra, Hydrodynamics of non-spherical particles in non-Newtonian fluids, *Handbook of Applied Polymer Processing Technology*, edited by N.P. Cheremisinoff and P.N. Cheremisinoff, Chapter 1, Marcel Dekker, New York (1996).
15. R.P. Chhabra, U.K. Ghosh, Y. Kawase and S.N. Upadhyay, Non-Newtonian effects in bubble column reactors, *Multiphase reactor and Polymerisation System Hydrodynamics*, edited by N.P. Cheremisinoff, pp.539-570, Gulf, Houston, (1996).
16. D. DeKee, R.P. Chhabra and D. Rodrigue, Hydrodynamics of free rise of bubbles in non-Newtonian polymer solutions, *Handbook of Applied Polymer Processing Technology*, edited by N.P. Cheremisinoff and P.N. Cheremisinoff, Chapter 3, Marcel Dekker, New York (1996).
17. R.P. Chhabra, Terminal velocity of particles, *Encyclopedia of Chemical Processing & Design*, edited by J.J. McKetta, Vol.57, pp.135-143, Marcel-Dekker, New York (1996).
18. R.P. Chhabra, Heat and mass transfer in rheologically complex systems, *Advances in the Flow and Rheology of Non-Newtonian Fluids*, edited by D.A. Siginer, D. DeKee and R.P. Chhabra, Chapter 39, Elsevier, Amsterdam (1999).
19. R.P. Chhabra, Wall effects on spheres falling axially in cylindrical tubes, *Transport Processes in Bubbles, Drops and Particles*, 2nd edition, Eds. D. DeKee and R.P. Chhabra, Taylor & Francis, New York, Chapter 13 (2002).
20. R. P. Chhabra, Fluid mechanics and heat transfer with non-Newtonian liquids in mechanically agitated vessels, *Advances in Heat Transfer*, 37, 77-178 (2003).

21. R. P. Chhabra, Non-Newtonian Fluids: An Introduction, *Rheology of Complex Fluids*, eds. A. P. Deshpande, J. Murali Krishnan & P. B. Sunil Kumar, Springer, Munich, Chapter 1 (2010).

(D) IN REFEREED JOURNALS

22. T. Sridhar, R.P. Chhabra, P.H.T. Uhlherr and O.E. Potter, Application of Hildebrand's fluidity model to non-Newtonian solutions, *Rheologica. Acta.* 17, 519-524 (1978).
23. R.P. Chhabra and P.H.T. Uhlherr, Estimation of zero shear viscosity of polymer solutions from falling sphere data, *Rheologica. Acta* , 18, 593-599 (1979).
23. R.P. Chhabra, P.H.T. Uhlherr and D.V. Boger, The influence of fluid elasticity on the drag coefficient for creeping flow around a sphere, *J.Non-Newt.Fluid Mech.*, 6, 187-199 (1979/1980).
24. R.P. Chhabra and P.H.T. Uhlherr, Sphere motion through non-Newtonian fluids at high Reynolds numbers, *Can.J.Chem.Eng.*, 58, 124-128 (1980).
25. R.P. Chhabra and P.H.T. Uhlherr, Wall effect for high Reynolds number motion of spheres in shear thinning fluids, *Chem.Eng.Commun.*, 5, 115-124 (1980).
26. R.P. Chhabra, T. Sridhar, P.H.T. Uhlherr and O.E. Potter, Predicting transport coefficients of liquids - a unified approach, *A.I.Ch.E.J.*, 26, 522-525 (1980).
27. R.P. Chhabra, A note on the viscosity of hydrocarbons, *Ind.J.Chem.*, 19A, 691-692 (1980).
28. R.P. Chhabra and P.H.T. Uhlherr, Creeping motion of spheres through shear thinning elastic fluids described by the Carreau viscosity equation, *Rheologica. Acta* , 19, 187-195 (1980).
29. R.P. Chhabra, C. Tiu and P.H.T. Uhlherr, Shear thinning effects in creeping flow about a sphere, *Rheology*, Vol.2, 9-16, Edited by G. Astarita, G. Marrucci and L. Nicolais, Plenum, New York (1980).
30. R.P. Chhabra and R.J. Hunter, The fluidity of molten salts, *Rheologica. Acta.*, 20, 203-206 (1981).
31. R.P. Chhabra, C. Tiu and P.H.T. Uhlherr, Creeping motion of spheres through Ellis model fluids, *Rheologica. Acta.*, 20, 346-351 (1981).
32. R.P. Chhabra, C. Tiu and P.H.T. Uhlherr, A Study of wall effects on the motion of a sphere in viscoelastic fluids, *Can.J.Chem.Eng.*, 59, 771-775 (1981).
33. R.P. Chhabra and J.F. Richardson, Comments on - A new concept for the calculation of pressure drop with hydraulic transport of solids in horizontal pipes, *Chem.Eng.Sci.*, 37, 1575-1578 (1982).
34. R.P. Chhabra, S.I. Farooqi, Z. Khatib and J.F. Richardson, The co-current flow of shear thinning liquids and air in horizontal and vertical pipes, *J.Pipelines*, 2, 169-185 (1982).
35. R.P. Chhabra, S.I. Farooqi, J.F. Richardson and A.P. Wardle, Co-current flow of air and shear-thinning suspensions in pipes of large diameter, *Chem.Eng.Res.Des.*, 61, 56-61 (1983).
36. R.P. Chhabra and T. Sridhar, Temperature dependence of self diffusion in liquid metals, *Phys.Chem.Liq.*, 13, 37-46 (1983).

- 37 R.P. Chhabra and J.F. Richardson, Hydraulic transport of coarse gravel particles in a smooth horizontal pipe, *Chem.Eng.Res.Des.*, 61,313-317 (1983).
- 38 R.P. Chhabra, Some remarks on drag coefficients of a slowly moving sphere in non-Newtonian fluids, *J.Non-Newt.Fluid Mech.*, 13, 225-227 (1983).
- 39 R.P. Chhabra, S.I. Farooqi and J.F. Richardson, Isothermal two-phase flow of air and aqueous polymer solutions in a smooth horizontal pipe, *Chem.Eng.Res.Des.*, 62, 22-32 (1984).
- 40 R.P. Chhabra and J.R. Raman, Slow non-Newtonian flow past an assemblage of rigid spheres, *Chem. Eng. Commun.*, 27, 23-46 (1984).
- 41 R.P. Chhabra and J.F. Richardson, Prediction of flow pattern for the co-current flow of gas and non-Newtonian liquid in horizontal pipes, *Can. J. Chem. Eng.*, 62, 449-454 (1984).
- 42 R.P. Chhabra, I. Machac and P.H.T. Uhlherr, Some further observations on the creeping Motion of spheres through Ellis model fluids, *Rheol.Acta*, 23, 457-460 (1984).
- 43 R.P. Chhabra and J.F. Richardson, Flow of liquid through screens: Relationship between pressure drop and flow rate, *Chem. Eng. Sci.*, 40, 313-316 (1985).
- 44 R.P. Chhabra and J.F. Richardson, Hydraulic transport of coarse particles in viscous Newtonian and non-Newtonian media in a horizontal pipe, *Chem. Eng. Res. Des.*, 63, 390-397 (1985).
- 45 R.P. Chhabra, Tracer diffusion in mercury: a predictive equation, *Metallurgical Transactions*, 17A, 355-358 (1986).
- 46 R.P. Chhabra and S.C. Dhingra, Creeping motion of a Carreau fluid past a Newtonian fluid sphere, *Can. J. Chem. Eng.*, 64, 897-905 (1986). Also see *ibid* 66, 176 (1988).
- 47 R.P. Chhabra, On terminal velocity formula for objects in a viscous fluid, *Journal of Hydraulic Research*, 24, 216-220 (1986).
- 48 S. Gummalam and R.P. Chhabra, Rising velocity of a swarm of spherical bubbles in a power law non-Newtonian Liquid, *Can.J.Chem.Eng.*, 65, 1004-1008 (1987).
- 49 R.P. Chhabra, Gas-liquid flows, *Chem. Eng. Res. Des.*, 65, 491-494 (1987).
- 50 R.P. Chhabra and P.H.T. Uhlherr, The influence of fluid elasticity on wall effects for creeping sphere motion in cylindrical tubes, *Can. J. Chem. Eng.*, 66, 154-157 (1988).
- 51 R.P. Chhabra, Some remarks on drag and mass transfer in multiple drop slow motion in power law fluid, *Chem. Eng. Sci.*, 43, 399-400 (1988).
- 52 A.K. Roy and R.P. Chhabra, Diffusivity of oxygen and nitrogen in liquid metals; An explicit formulation, *Zeit.Fur Metallekunde*, 79, 64-67 (1988).
- 53 A.K. Roy and R.P. Chhabra, Prediction of solute diffusion coefficients in liquid metals, *Metallurgical Transactions*, 19A, 273-279 (1988).
- 54 R.P. Chhabra, Effect of pipe diameter on pressure drop for solid-liquid mixtures flowing in the form of a sliding bed in horizontal pipes, *Int.J.Eng.Fluid Mech.*, 1, 533-544 (1988).

- 55 S. Gummalam, K.A. Narayan and R.P. Chhabra, Rise velocity of a swarm of spherical bubbles through a non-Newtonian Fluid: Effect of zero shear viscosity, *Int.J.Multiphase Flow*, 14, 361-373 (1988).
- 56 D. DeKee and R.P. Chhabra, A photographic study of shapes of bubbles and coalescence in non-Newtonian polymer solutions, *Rheologica. Acta*, 27, 656-660 (1988).
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(G) PRESENTATIONS AND INTERNAL REPORTS

1. R.P. Chhabra, S.I. Farooqi, J.F. Richardson and A.P. Wardle, Examination of operating characteristics of pipeline from Blackpool to Par, Report prepared for *English Clays Lovering Pochin & Co. Ltd.*, U.K., (1982).
2. R.P. Chhabra and J.F. Richardson, Co-current flow of air and shear thinning materials in horizontal and vertical pipes, paper presented at *Rheology in Crude Oil Production*, London, 13-15th April, (1983).

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7. R.P. Chhabra, Slow motion of liquid drops rheologically complex fluids, paper presented in *National Symposium on Modelling and Simulation in Chemical Engineering*, Bangalore, August 22-24, (1985).
8. R.P. Chhabra, Fixed beds and Fluidized beds - An Overview, presented in *Intensive course on Computer Applications in Metallurgical Engineering*, I.I.T. Kanpur (1986).
9. R.P. Chhabra, Experimental determination of viscosity and diffusion coefficient in molten metallic systems presented in *Intensive Course on Experimental Methods in Metallurgy*, I.I.T. Kanpur (1987).
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12. A.A. Soares, R.P. Chhabra, J.M. Ferreira and J.A.M.S. Duarte, A numerical study of the steady state flow of non-Newtonian fluids around a cylinder, *Fisica 2002/13th National Conference on Physics*, Evora, Sept., 6-10 (2002).
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17. A. A. Soares, R. P. Chhabra, J. M. Ferreira and L. Caramelo, Effects of Viscous Dissipation on Heat Transfer between an Array of Long Circular Cylinders to Newtonian Fluids at $Re = 100$.

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(H) OUTSIDE INVITED SEMINARS

Indian Institute of Technology, Delhi (1985)
Thapar Corporate R&D Centre, Patiala (1986)
Monash University, Melbourne (1986, 1987, 1993, 1994, 2006)
University of Melbourne, Melbourne (1986)
Royal Melbourne Institute of Technology, Melbourne (1986, 2006, 2010)
State University of New York at Buffalo, Buffalo (1987)
University of Toronto, Toronto (1987, 1992)
Ottawa University, Ottawa (1987, 1992)
Ecole Polytechnique of Montreal, Montreal (1987, 1990, 1992, 2001, 2007)
University of Windsor, Windsor (1987, 1988)
Banaras Hindu University, Varanasi (1990, 2008)
University of Waterloo, Waterloo (1990, 1992, 2008)
Clarkson University, Potsdam (1991, 1992, 1995, 2001, 2007)
University of West Virginia, Morgantown (1992, 2007)
University of Massachusetts, Amherst (1992)
Michigan State University, East Lansing (1992)
University of Laval, Quebec (1992)
McMaster University, Hamilton (1992)
Drexel University, Philadelphia (1992)
Indian Institute of Technology, Bombay (1993, 2002)
University of New South Wales, Sydney (1993, 1999)
University of Adelaide, Adelaide (1996, 1997)
The University of New Castle, Callaghan (1996, 1997)
University of Francois Rabelais, Tours (1998)
Universite de Nantes, Nantes (1998, 2000, 2002, 2003, 2005, 2007, 2009, 2011)
EFPG, INPG, Grenoble (1998, 2000, 2002, 2003, 2005, 2007, 2011)
University College London, London (1998)
University of Wales, Swansea (1998)
University of Porto, Porto (1998)
Cape Technikon, Capetown (1999, 2000, 2001, 2004)
University of Cape Town, Cape Town (1999)
University of Natal, Durban (1999)
University of Stellenbosch, Stellenbosch (1999)
University of Sydney, Sydney (1999)
University of Lund, Lund (2000)
The University of Western Ontario, London, (2002, 2007, 2008, 2010)
Sherritt International, Edmonton, Alberta (2002)
LMSGC, Champs sur Marne, Paris (2002)
University of Surrey, Guildford (2002)
Indian Institute of Technology, Roorkee (2002)
Indian Institute of Science, Bangalore (2002)
John F. Welch Technology Centre, Bangalore (2002)

ENSIC-CNRS, Nancy (2003, 2007)
Polytechnique, University of Marseille, Marseille (2003)
National Chemical Laboratory, Pune (2004)
Tata Research, Design and Development Center, Pune (2004)
Tokyo Institute of Technology, Tokyo (2004)
Osaka University, Osaka (2004)
The University of Hyogo, Himeji (2004)
Kobe University, Kobe (2004).
Institute for Chemical Research, Kyoto University, Kyoto (2004).
Laboratory for Food Process Engineering (INRA), Villeneuve d'Ascq, Lille (2005).
Technical University of Delft, Delft (2005)
Technical University of Eindhoven, Eindhoven (2005).
Cape Peninsula University of Technology, Cape Town (2006, 2008, 2010)
Sultan Qaboos University, Muscat (2006).
Exxon-Mobil Research & Engineering Company, Annandale, NJ (2007).
Purdue University, West Lafayette, IN (2007).
University of Liverpool, Liverpool (2007).
University of Sheffield, Sheffield (2007).
Institut Français du Pétrole, Rueil Malmaison (2007).
Technical University of Graz, Graz (2007).
LSTM, University of Erlangen-Nuremburg (2007).
University of South Paris, Paris (2007)
University of Southampton, Southampton (2008)
Apex Institute of Technology, Kaushal Puri (U.P.) (2009)
University of Saskatchewan, Saskatoon (2010)
University of British Columbia, Vancouver (2010)
Laboratoire Inter-disciplinary Physics, Université Joseph Fourier, Grenoble (2011)
ENSAM, Angers, France (2011)
University of Miskolc, Miskolc, Hungary (2011).
CEMAGREF, Clermont Ferrand, France (2011).

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