Krishna M. SINGH

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RESEARCH INTERESTS

- Fluid Dynamics: Numerical simulation of turbulent flows in complex geometries
- Computational Mechanics: Parallel numerical algorithms for continuum problems, mesh free methods.
- Modeling, Simulation and CAD of thermo-fluid systems (energy systems)

PERSONAL INFORMATION

Date of Birth: March 2, 1965 Nationality: Indian

EDUCATION

Ph. D.	Indian Institute of Technology, Kanpur	1993	Grade: 9.5/10
M. Tech.	Indian Institute of Technology, Kanpur	1988	Grade: 8.6/10
B. Tech.	Indian Institute of Technology, BHU., Varanasi	1986	Grade: 8.8/10

EMPLOYMENT

Oct.2012	_	to date	Associate Professor, Indian Institute of Technology, Roorkee, India.
Sep.2003	_	Oct.2012	Assistant Professor, Indian Institute of Technology, Roorkee, India.
Jun.2000	_	Aug.2003	Research Assistant, Queen Mary, University of London, London, UK
Nov.1999	_	Mar.2000	Assistant Professor, Shinshu University, Nagano, Japan.
Nov.1997	_	Oct. 1999	JSPS Post-doctoral Fellow, Shinshu University, Nagano, Japan.
May 1995	_	Oct.1997	Scientist `C', Defence Metallurgical Research Lab., Hyderabad, India
Dec.1994	_	May 1995	Research Engineer, Transoft International (P) Ltd., Bangalore, India
Aug. 1993	_	Dec.1994	Senior Project Engineer/Associate, IIT-Kanpur, India.

OTHER PROFESSIONAL EXPERIENCE

Nov 2013	—	Dec 2013	Visiting Researcher, Queen Mary, University of London, UK
June 2012	_	July 2012	Visiting Researcher, Queen Mary, University of London, UK
Dec. 2010	-	Dec.2010	Visiting Researcher, Nagoya University, Nagoya, Japan.
Sep.2003	_	Sept.2007	Honorary Visiting Lecturer, Queen Mary, University of London, UK
Aug.2006	_	Dec.2006	Visiting Researcher, Shinshu University, Nagano, Japan.
May 2005	_	July 2005	Visiting Researcher, Shinshu University, Nagano, Japan.

HOUNORS/AWARDS

- JSPS Post Doctoral Fellowship (JSPS, Japan): 1997-1999
- Institute Fellowship, IIT, Kanpur, India: 1986-1993

- National Merit Scholarship (Govt. of India): 1980-86
- State Merit Scholarship (Govt. of Uttar Pradesh, India): 1978 1980

PROFESSIONAL AFFILIATIONS / ACTIVITIES

A. MEMBERSHIP OF PROFESSIONAL SOCIETIES

- Member of the American Society of Mechanical Engineers (ASME)
- Senior Member of the American Institute of Aeronautics and Astronautics (AIAA)

B. JOURNAL REVIEWS

Reviewer for many international journals in Computational Mechanics/Fluid Dynamics, e.g.

- (i) International Journal for Numerical Methods in Engineering
- (ii) Engineering Analysis with Boundary Elements
- (iii) International Journal of Numerical Methods for Heat & Fluid Flow
- (iv) Numerical Heat Transfer
- (v) ASME Journal of Fluids Engineering
- (vi) ASCE Journal of Hydraulic Engineering

C. SHORT TERM COURSES

- Two week short term course on "Computational Fluid Dynamics" under Faculty Development Program sponsored by AICTE, MHRD, Govt. of India, June 2008.
- One week short term course on "Computational Fluid Dynamics" under Quality Improvement Program sponsored by AICTE, MHRD, Govt. of India, July 2009.
- One week short term course on "Tools and techniques of CFD" under Quality Improvement Program sponsored by AICTE, MHRD, Govt. of India, July 2010.
- Three days short term course on "Computational Fluid Dynamics" jointly organized with Institution of Engineers (India), Roorkee Local Chapter, August 2010.

RESEARCH AND CONSULTANCY PROJECTS

A. RESEARCH

- *LES/DNS of turbulent flows in complex geometries* (with Dr Eldad Avital and Prof. John Williams, Queen Mary, University of London), UK Turbulence Consortium / EPSRC, UK (Funding in the form of Super-computing Resources). On going.
- Fast multipole (FMM) accelerated Krylov subspace solvers for boundary element analysis of potential and acoustic problems (with Prof. Toshiro Matsumoto, Nagoya University, Japan). On going.

C. CONSULTANCY

- Study and Design of Ventilation System of Traffic Tunnel of Larji HEP. HP State Electricity Board. Rs. 4.41 Lacs, Nov. 2010-Oct. 2011. (with Prof. B. K. Gandhi).
- Aerodynamic behavior of passenger trains and development of aerodynamic profiles of coaches and locomotive to reduce wind resistance. RDSO, Lucknow. Rs. 19.5 Lacs. April 2008-December 2009. (with Prof. V. K. Goel and Prof. B. K. Gandhi)
- *CFD Analysis of sump model for re-circulating cooling water system for MA-DMF plant of M/s Chemanol.* Simon India Ltd., New Delhi. Rs. 3.37 Lacs, Dec. 2007-Feb. 2008. (with Prof. B. K. Gandhi).
- Investigation on flow induced stresses in the centrifugal fans used for transformer oil cooling, Northern Railways, Ghaziabad. Rs. 2.24 Lacs, 2005-2007. (with Prof. B. K. Gandhi).
- Automatic quadrilateral grid generation, Ulsan University, Korea. Rs. 1.89 Lacs, 2004-2005. (with Prof. B. K. Gandhi)

TEACHING/ACADEMIC EXPERIENCE

A. CURRICULUM DEVELOPMENT

Member of the Committees on Curriculum Development for Undergraduate and Postgraduate Courses at

- IIT-Roorkee (2004-2010) and
- Shinshu University, Nagano, Japan (1999-2000).

B. WEB/VIDEO COURSES (under NPTEL program of MHRD, Govt. of India)

- > Developed a web course on Computational Fluid Dynamics
- > Developing a video course on Computational Fluid Dynamics

C. TEACHING

- As Course Instructor/Coordinator (for full courses which include lectures, tutorials and laboratory instruction) (at IIT-Roorkee, since September 2003)
 - Undergraduate Courses
 - 1. Fluid Mechanics (Autumn 2012, Spring 2004, 2005, 2006)
 - 2. Fluid Mechanics and Machinery (Autumn 2007)
 - 3. Thermodynamics (Spring 2009, Spring 2010, Autumn 2010)
 - 4. Manufacturing Techniques (Autumn 2009, Autumn 2010)
 - **5.** Computer Graphics (Autumn 2011, Autumn 2012)
 - 6. Computer Systems and Programming (Spring 2005, 2006, 2007, 2008, 2010, 2011, 2012, 2013, Autumn 2013 and Summer 2007)

• Post-graduate Courses

- 1. Advanced Fluid Mechanics (Autumn 2007, 2008, 2009)
- 2. Computational Fluid Dynamics and Heat Transfer (Spring 2007, 2008, 2009)
- 3. Modeling and Simulation (Autumn 2004, Spring 2010, Spring 2014)
- 4. Advanced Heat Transfer (Autumn 2005)
- 5. Advanced Thermodynamics (Autumn 2003)

> As Tutor / Laboratory Instructor

• At IIT-Roorkee (2003-onwards, in various semesters)

- **1.** Thermodynamics (Tutor)
- 2. Manufacturing Techniques (Lab. Instructor)
- 3. Engineering Graphics (Lab. Instructor)

• Queen Mary, University of London (2001- 2003)

- **1.** Dynamics (Tutor)
- 2. Fluid Mechanics Laboratory (Lab. Instructor)
- **3.** Heat Transfer Laboratory (Lab. Instructor)
- 4. Dynamics Laboratory (Lab. Instructor)

DETAILS OF PROFESSIONAL EXPERIENCE

Sep. 2003 - to date: Assistant Professor, Indian Institute of Technology, Roorkee, India.

Areas of interest: Computational Mechanics and Fluid Dynamics

Current research

- Analysis and numerical simulation of turbulent flows in complex geometries
- Aerodynamics of rail vehicles
- Modeling and simulation of turbo-machines and solar air heaters
- Development of efficient parallel numerical algorithms for LES/DNS
- Fast multipole method and GMRES solvers for BEM
- Mesh free methods for heat transfer problems

Teaching

• Post-graduate: Fluid Dynamics, Heat Transfer, CFD, Modeling and Simulation

• Under-graduate: Fluid Mechanics, Programming (in C++), Thermodynamics Administration

Officer-in-charge (OC) of CFD Lab., OC Placement, OC Aerodynamics and Solar Energy Lab., O.C. Maintenance., Dy. Superintendent Examination

Other academic duties

Member of the Committees on Curriculum Development for Undergraduate and Post-graduate Courses; Examiner for B. Tech. and M. Tech. projects.

Current thesis supervision: 2 Ph. D. plus 1 M. Tech. student

Jun. 2000 - Aug. 2003: Research Assistant, Queen Mary, University of London, London

Areas of interest: *Turbulence, CFD and Parallel Programming.* **Research profile**

- High resolution LES and DNS of incompressible turbulent flows ---analysis of coherent structures, and turbulence statistics.
- Development of multilevel preconditioners for problems on arbitrarily complex geometry based on fictitious domain and domain decomposition.

Teaching:

Tutorials in Dynamics, and labs. in Fluid Mechanics, Heat Transfer and Dynamics.

Nov. 1999 - Mar. 2000: Research Assistant Professor, Shinshu Univ., Nagano, Japan. Areas of interest: CFD, Inverse Problems.

Research profile

Boundary element analysis of inverse heat transfer problems --Development of novel algorithms based on iterative regularization.

Teaching

Guidance of graduate students in Computational Mechanics; Curriculum development.

Nov. 1997 - Oct. 1999: JSPS Post-doctoral Fellow, Shinshu Univ., Nagano, Japan.

Areas of Interest: CFD, Environmental Transport Problems

Research profile

Boundary element analysis of environmental transport:

- Development of BE software for environmental transport problems.
- Accurate evaluation of singular boundary integrals.
- Aspects of temporal discretization and coordinate functions in the DRBE analysis of transient transport problems.

May 1995 - Oct.1997: Scientist `C', Defence Metallurgical Research Lab., Hyderabad Areas of Interest: Continuum Mechanic, FEM and CAD.

Job Profile

- Finite element analysis, computer aided design of die and process optimization for metal forming and powder metallurgy processes.
- Development of an adaptive finite element code and unstructured mesh generator for analysis of large deformation.

Nature of work: Industrial R&D (worked as a part of a small team).

Dec.1994 - May 1995: Research Engineer, Transoft International (P) Ltd., Bangalore

Areas of Interest: Geometric Modeling, CAD, Software Engineering.

Project: *Design and development of a solid modeler (Fluidyn CAD)*

Nature of work: Industrial R&D (worked as a part of a small team).

June 1994 - Dec. 1994: Senior Project Engineer, IIT-Kanpur, India.

Areas of Interest: Computational Fluid Dynamics, Aerodynamics

Project:

Transonic flow around 3-D complex geometry: using a hybrid panel method – finite volume method based on FPE in conjunction with Prandtl-Glauert transformation.

Aug. 1993 - May1994: Senior Project Associate, IIT-Kanpur, India.

Area of Interest: Turbulence and Computational Fluid Dynamics

Main project:

Simulation of turbulent flow field in the spiral casing of a hydraulic turbine

Nature of work: Industrial R&D (sponsored by BHEL, India).

LIST OF PUBLICATIONS

JOURNAL PAPERS

- 1. H. C. Thakur, **K.M. Singh** and P. K. Sahoo. Phase Change Problems using MLPG Method. *Numerical Heat Transfer, Part A: Application,* **59** (6), 438 458, 2011.
- 2. H. C. Thakur, **K.M. Singh** and P. K. Sahoo. MLPG analysis of Nonlinear Heat Conduction in Irregular Domains. *Computer Modeling in Engineering & Sciences*, 68(2), 117-150, 2010.
- 3. B. K. Gandhi, **K. M. Singh**. Experimental and numerical study of flow in a roughened duct. *Journal of the Institution of Engineers* (India), 90, pp. 13-18, 2010.
- H. C. Thakur, K.M. Singh and P. K. Sahoo. Meshless local Petrov-Galerkin method for nonlinear heat conduction problems. *Numerical Heat Transfer, Part B: Fundamentals*, 56, 393 – 410, 2009.
- 5. A. Mittal, B. K. Gandhi and **K. M. Singh**. Improvement in design of centrifugal impeller used for oil cooling blower system using CFD A case study. *Proc. IMechE, Part A: Journal of Power and Energy*, **223**, 981-989, 2009.
- 6. S.B. Prasad, J.S. Saini and **K. M. Singh**. Investigation of heat transfer and friction characteristics of packed bed solar air heater using wire mesh as packing material. *Solar Energy*, **83** (5), 773-783, 2009
- 7. K. M. Singh, N. D. Sandham and J. J. R. Williams. Numerical simulation of flow over a rough bed. *Journal of Hydraulic Engineering*, **133** (4), 386-398, 2007.
- 8. **K. M. Singh** and M. Tanaka. Elementary analytical integrals required in subtraction of singularity method for evaluation of weakly singular boundary integrals. *Engineering Analysis with Boundary Element*, **31**, 241-247, 2007.
- 9. K. M. Singh, M. Tanaka, Y. Arai and T. Matsumoto. Flexible GMRES solver for boundary element analysis of acoustic fields. *Transactions of the Japan Society for Computational Methods in Engineering and Science*, 6 (2), 79-84, 2006.
- M. Tanaka, T. Matsumoto, K. M. Singh and K. Kurokawa. A DRBEM for the solution of nonlinear steady-state heat conduction problems in anisotropic solids (study on 2-D cases). *Transactions of the Japan Society for Computational Methods in Engineering and Science*, 6 (2), 115-120, 2006.
- 11. **K. M. Singh** and J. J. R. Williams. A parallel fictitious domain multigrid preconditioner for the solution of Poisson equation in complex geometry. *Computer Methods in Applied Mechanics and Engineering*, **194** (45-47), 4845-4860, 2005.
- 12. K. M. Singh and J. J. R. Williams. Application of the additive Schwarz method to large scale Poisson problems. *Communications in Numerical Methods in Engineering*, **20**, 193-205, 2004.
- K. M. Singh and M. Tanaka. Dual reciprocity boundary element analysis of transient advection-diffusion. *International Journal of Numerical Methods for Heat & Fluid Flow*, 13(5), 633-646, 2003.
- 14. K. M. Singh and M. Tanaka. Dual reciprocity boundary element analysis of inverse heat conduction problems. *Computer Methods in Applied Mechanics and Engineering*, **190**, 5283-5295, 2001.

- 15. K. M. Singh and M. Tanaka. On nonlinear transformations for accurate numerical evaluation of weakly singular boundary integrals. *International Journal for Numerical Methods in Engineering*, **50** (8), 2007-2030, 2001.
- 16. **K. M. Singh** and M. Tanaka. Analytical integration of weakly singular integrals in boundary element analysis of Helmholtz and advection-diffusion equations. *Computer Methods in Applied Mechanics and Engineering*, **189**(2), 625-640, 2000.
- 17. K. M. Singh and M. S. Kalra. Least squares finite element schemes in the time domain. *Computer Methods in Applied Mechanics and Engineering*, **190**(1-2), 111-131, 2000.
- 18. K. M. Singh and M. Tanaka. On exponential variable transformation based boundary element formulation for advection-diffusion problems. *Engineering Analysis with Boundary Elements*, 24(3),225-235, 2000.
- 19. M. Tanaka and **K. M. Singh**. Application of DRBEM and iterative regularization to inverse heat conduction problems. *Transactions of the Japan Society for Computational Engineering and Science*, **2**, 2000.
- K. M. Singh and M. Tanaka. Dual reciprocity boundary element analysis of nonlinear diffusion: Temporal discretization. *Engineering Analysis with Boundary Elements*, 23, pp. 419-433, 1999.
- 21. **K. M. Singh** and M. Tanaka. Analytical evaluation of weakly singular integrals for Helmholtz equation. *Transactions of the Japan Society for Computational Engineering and Science*, **1**, pp. 161-166, 1999.
- 22. N. Ramakrishnan, **K.M. Singh**, R.K.V. Suresh, and N. Srinivasan. An algorithm based on total-elastic-incremental-plastic strain for large deformation plasticity. *Journal of Materials Processing Technology*, **86**, pp. 190-199, 1999.
- 23. K. M. Singh and M. S. Kalra. Three and four step least squares finite element schemes in time domain. *Communications in Numerical Methods in Engineering*, **12**, pp. 425-431, 1996.
- 24. K. M. Singh and M. S. Kalra. Time integration in the dual reciprocity boundary element analysis of transient diffusion. *Engineering Analysis with Boundary Elements*, 18, pp. 73-102, 1996.
- 25. K. M. Singh and M. S. Kalra. Application of cubic Hermitian algorithms to boundary element analysis of heat conduction. *International Journal for Numerical Methods in Engineering*, **38**, pp. 2639-2651, 1995.
- 26. K. M. Singh and M. S. Kalra. On cubic Hermitian interpolation based time integration methods. *International Journal for Engineering Analysis and Design*, **2**, pp. 1--6, 1995.
- 27. K. M. Singh and M. S. Kalra. Least squares finite element formulation in time domain for the dual reciprocity boundary element method in heat conduction. *Computer Methods in Applied Mechanics and Engineering*, *104*, pp. 147-172, 1993.

CONFERENCE PROCEEDINGS

- 1. Tarun, B. K. Gandhi and **K. M. Singh**. Prediction of pressure pulsations in Francis turbine. *Proc. of 38th National Conference on Fluid Mechanics and Fluid Power* (FMFP-2011), December 15-17, 2011, MANIT, Bhopal.
- 2. Harish Kumar, K. M. Singh and B. K. Gandhi. Numerical simulation of flow field and pollutant dispersion in a long highway tunnel. *IASTED International Conference on*

Modeling, Simulation and Identification (MSI 2011), November 5-7, 2011, Pittsburgh, USA.

- 3. Tarun Parashar, B. K. Gandhi and **K. M. Singh**. Numerical simulation of flow through a Francis turbine. *IASTED International Conference on Modeling, Simulation and Identification* (MSI 2011), November 5-7, 2011, Pittsburgh, USA.
- 4. Siddharth Jain, Lokender Singh, B. K. Gandhi and K. M. Singh. Experimental investigation on aerodynamic shape of Indian Railway train with diesel loco WDP-4GM: A case study. *ENERSTATE-2010 International Conference on Clean Energy Technologies and Energy Efficiency for Sustainable Development*, Dehradun, December 27-29, 2010.
- 5. Lokender Singh, B. K. Gandhi and **K. M. Singh**. Aerodynamic shape optimization of existing railway trains. *Proc. International Conference on Advances in Mechanical Engineering*, SVNIT, Surat, India, August 3-5, 2009.
- 6. S. B. Prasad, J. S. Saini, and **K. M. Singh**. Effect of porosity on the performance of wire mesh packed bed solar air heater. *Proc. of International Conference on Emerging Research and Advances in Mechanical Engineering* (ERA 2009), Velammal Engineering College, Chennai, 302-307, 2009.
- S. B. Prasad, J. S. Saini, and K. M. Singh. Investigation of enhancement of thermal performance of packed bed solar air heater using wire mesh as packing material. 19th National & 8th ISHMT-ASME Heat and Mass Transfer Conference, JNTU Hyderabad, India, January 3 - 5, 2008.
- 8. H. C. Thakur and **K.M. Singh**. Meshfree methods and their applications. *National Conference on State of Art Technologies in Mechanical Engineering*, October 2007, G.B. Pant Technical University, Pant Nagar.
- 9. H. C. Thakur and **K.M. Singh**. Meshless local Petrov-Galerkin method (a truly meshfree method): An overview. *IAWS-CFD 2007 (Indo-Australian Workshop on A CFD Approach on Fluid Flow, Heat and Mass Transfer & CFD Applications in Multidisciplinary Areas*), 12-14 April, 2007, IIT-Roorkee, India. (CD Book)
- 10. S. S. Gupta, B. K. Gandhi and K. M. Singh. Numerical investigation of heat transfer and fluid flow characteristics in solar air heater duct with chamfered ribs mounted on absorber plate. *National Seminar on CFD - The New Third Dimension in Flow Analysis and Thermal Design*, May, 7-8, 2007, Rajiv Gandhi Technological University, Bhopal.
- 11. A. Mittal, A. P. Gupta, B. K. Gandhi and **K. M. Singh**. CFD analysis of an axial-centrifugal flow system used for transformer oil cooling. *National Seminar on CFD The New Third Dimension in Flow Analysis and Thermal Design*, May, 7-8, 2007, Rajiv Gandhi Technological University, Bhopal.
- J. J. R. Williams and K. M. Singh. Structure of the turbulent flow over a rough bed. *The 6th Int. Conf. on Hydroscience and Engineering (ICHE-2004)*, May 30-June 3, 2004, Brisbane, Australia. (CD Book: Invited paper).
- 13. S. S. Sehgal, R. P. Gakkhar and **K. M. Singh**. Liquid fuel combustion within submerged flame porous burner. *19th National Conference on IC Engines and Combustion*, Dec. 21-23, 2005, Annamalainagar, India.
- 14. K. M. Singh and J. J. R. Williams. A fictitious domain multigrid preconditioner for the solution of Poisson equation in complex geometry. XIII National Conference of Indian Society of Mechanical Engineers (ISME-2003), IIT-Roorkee, India, Dec. 30-31, 2003, Roorkee (CD Book: Paper no. TH-122).
- 15. K. M. Singh and J. J. R. Williams. Direct Numerical Simulation of Flow Over a Rough Bed.

Proc. International Symposium on Shallow Flows (Delft, Holland, June 16-18th, 2003), Part III, pp. 45-50.

- 16. M. Tanaka and **K. M. Singh**. Application of DRBEM and iterative regularization to inverse heat conduction. In *Proc. of the International Symposium on Inverse Problems in Engineering Mechanics (ISIP200)* (Nagano, Japan), Elsevier, 2000.
- 17. M. Tanaka and **K. M. Singh**. A semi-numerical method based on singularity subtraction and nonlinear transformation for singular boundary integrals. In *Proc. of the 16th JASCOME Symposium on BEM*, pages 87-92. JASCOME, Tokyo, Japan, 1999.
- K. M. Singh and M.Tanaka. Analytical evaluation of weakly singular boundary integrals for advection-diffusion equation. In C. A. Brebbia and H. Power, editors, *Boundary Elements XXI*, pp. 649-658, WIT Press, Southampton, 1999.
- 19. K. M. Singh and M. Tanaka. An alternative boundary element formulation for steady state advection-diffusion problems. In *Proc. of the 9th BEM Technology Conference (BTEC-99)*, pages 69-74. JASCOME, Tokyo, Japan, 1999.
- K. M. Singh and M. Tanaka. On accurate evaluation of boundary element integrals for advection-diffusion and Helmholtz equations. In *Proc. of the 15th JASCOME Symposium on BEM*, pages 1-6. JASCOME, Tokyo, Japan, 1998.
- K. M. Singh and M. Tanaka. Application of DRBEM to convection-dominated transient convection-diffusion problems. In *Proc. of the 76th JSME Conference, Volume 2*, pages 179-180. JSME, Sendai, Japan, 1998.
- 22. K. M. Singh and M. Tanaka. Application of DRBEM to transient advection-diffusion problems. In *Proc. of the 53rd JASCOME Forum, Volume BEM 98-53*, pages 1-12. JASCOME, Tokyo, Japan, September 30 1998.
- 23. **K. M. Singh** and M. Tanaka. Dual reciprocity BEM for advection-diffusion problems: Temporal discretization aspects. In *Proc. of the 8th BEM Technology Conference (BTEC-98)*, pages 79-84. JASCOME, Tokyo, Japan, 1998.
- N. Ramakrishnan, R. K. V. Suresh, K. M. Singh and N. Srinivasan. A viscoplastic type constitutive basis for large deformation plasticity. *Plasticity and Impact Mechanics (IMPLAST'96)*, Tata McGraw Hill, New Delhi, 1996.
- 25. N. V. Rao, N. Ramakrishnan and **K. M. Singh**. Generation of finite element mesh for microstructural geometry using image-processing techniques. In M. Vidyasagar, editor, *Intelligent Robotic Systems (Proc. ISIRS'95)*, pages 106-112, Tata McGraw Hill, New Delhi, 1996.
- 26. K. M. Singh and M. S. Kalra. Hermitian interpolation based time integration methods for DRBEM in transient diffusion. In *Proc. 1st ASME-ISHMT Conference and 12th National Heat and Mass Transfer Conference*, pages 559-564. Tata McGraw Hill, New Delhi, 1994.
- 27. K. M. Singh and M. S. Kalra. A dual reciprocity boundary element method in transient heat conduction with nonlinear boundary conditions. In *Proc. 10th National Heat and Mass Transfer Conference*, pages 467-474. Indian Society for Heat and Mass Transfer, 1989.
- 28. **K. M. Singh** and M. S. Kalra. A least squares time integration scheme for the dual reciprocity BEM in transient heat conduction. In R. W. Lewis and K. Morgan, editors, *Numerical Methods in Thermal Problems VI*, pp. 216-226. Pineridge Press, Swansea, UK, 1989.

RESEARCH/DESIGN/CLOSURE REPORTS

- 1. B.K. Gandhi and **K. M Singh.** *Study and Design of Ventilation System of Traffic Tunnel of Larji HEP*. HP State Electricity Board, 2011. (46 pages)
- 2. V. K. Goel, B.K. Gandhi and K. M Singh. Aerodynamic Behavior of Passenger Trains and Aevelopment of Aerodynamic Profiles of Coaches and Locomotive to Reduce Wind Resistance. RDSO, Lucknow. Final Report on RDSO Consultancy Project, RDSO, Luck now, India, 2009.
- 3. B.K. Gandhi and **K. M Singh.** *Analysis of Sump Model for Recirculating Cooling Water System for MA-DMF Plant of M/S Chemanol* Closure Report on Consultancy Project, M/S Simon India Ltd, 2008.
- 4. B.K. Gandhi and **K. M Singh.** *Investigation on Flow Induced Stresses in the Centrifugal Fans Used for Transformer Oil Cooling.* Closure Report on RDSO Consultancy Project, Northern Railways, Ghaziabad, India, 2007.
- 5. B.K. Gandhi and **K. M Singh.** *Automatic Quadrilateral Grid Generation in 2D* Final Report on Korean Consultancy Project for Ulsan University, Korea, 2004.
- J. J. R. Williams, N. D. Sandham and K. M. Singh. Numerical Simulation of Flow over a Rough Bed. Final Report on EPSRC, UK Grant GR/M85241/01, November 2003. (This project was rated 'outstanding' by UK EPSRC Review Committee.)
- 7. K. M. Singh and M. Tanaka. *Development of Boundary Element Computational Simulator for Environmental Problems*. JSPS Research Report (P97334), November 1999, Shinshu University, Nagano, Japan.
- 8. **K. M. Singh** and N. Ramakrishnan. *Unstructured Mesh Generation in Arbitrarily Complex Planar Regions using GEOM2D*. DMRL Technical Report: DMRL TR 97 217, May 1997, DMRL, Hyderabad, India.
- 9. **K.M. Singh**. Least Squares Finite Element Formulations in Time Domain with Applications in Boundary Element Analysis. PhD thesis, Indian Institute of Technology, Kanpur, India, 1993.
- 10. **K.M. Singh**. *Application of dual reciprocity BEM in nonlinear transient heat conduction*. Master's thesis, Indian Institute of Technology, Kanpur, India, 1988.