

P. A. Lakshminarayanan

A. Name

P. A. Lakshminarayanan
Old 99, New 201, Thambu Chetty Street, Chennai, 600 001 Telephone (91)-98-40-850068

B. Father

P.A. Arumugam
Retired Senior Officer, Grindlays Bank, Madras-60001

C. Date of Birth 26- April 1950

D. Education

1.	St. Gabriel's High School, Madras	SSLC	1965
2.	Loyola College, Madras	PUC	1966
3.	Indian Institute of Technology, Madras	B. Tech	1971
4.	Indian Institute of Technology, Madras	MS by Research	1974
5.	Indian Institute of Technology, Madras	Ph. D.	1979

E. Scholarships

1.	National Merit Scholarship, 25th rank in the State of Madras in 1965	1965-69
2.	IIT entrance, 5 in the southern zone and 25 all-India rank	
3.	IIT Merit Scholarship	1966-71
4.	British Science and Engineering Research Council Fellowship at the University of Technology, Loughborough, UK	1978-82

F. Ranks and Awards

1.	National: Best paper prize at National Conference for IC Engines and Combustion, XII, Dehradun for the paper on Vibrations of a 3-Cylinder Engine	1992
2.	National: Automotive Engineer of the Year award from the Institute of Automotive Engineers (India) (now SAE India)	1994
3.	International: Arch T Colwell Merit Award, SAE (USA) for the paper on Evaporating and combusting Diesel Sprays	1984
4.	All-India First rank in the IES, Indian Engineering Services, UPSC examination	1974
5.	Within the top 4 out of 250 in the entire B Tech 1971, from Madras IIT	1971
6.	5 th from the South Zone and 25 th All India in the IIT entrance exam	1966
7.	25 th from the entire state of Madras, Secondary School Leaving Certificate Examination	1964
8.	Performance award by Kirloskar for creditable contribution	
9.	Listed in the Who's Who in the World and Who's Who in the Finance and Industry, Marquis Publications	1997-
10.	Second prize, AVL Advanced Simulation Technology, Graz for the paper on Heat release in Direct Injection Diesel Engines	2005
11.	Second prize, AVL Simulation Technology, Pune for the paper on Computational Fluid Dynamics	2008
12.	SAE (Intl.) Fellowship	2009
13.	Special Prize for a paper on the transient performance of Diesel Engines, AVL Conference, Pune 2010	2010
14.	Fellowship, The Indian National Academy of Engineering (INAE)	2013
15.	Fellowship, International Society for Energy, Environment and Sustainability	2018

G. Work Experience

1.	Res. Associate to Prof. JC Dent, University of Technology, Loughborough, UK	1978 -1982
2.	Senior Manager, R&D, Kirloskar Oil Engines Limited	1983 -1994
3.	General Manager, R&D, Kirloskar Oil Engines Limited	1994 -1997
4.	Senior General Manager, R&D, Kirloskar Oil Engines Limited	1997- 2002
5.	Head, Engines R&D, Ashok Leyland, Hosur	2002 -2010
6.	On Contract for design and development of advanced engines, Ashok Leyland, Hosur	2010 -2011
7.	Chief Technology Officer, Simpson and Co Ltd., Madras	2011 – 2016
8.	Technical Advisor, Simpson and Co. Ltd., Madras	2016-2018
9.	Visiting Professor, IIT Kanpur, India	2024-

H. Interaction with Educational Institutions to guide students to higher degrees

1.	M Tech. Guidance at College of Engineering Pune	4	1983-2001
2.	M. Tech Guidance at IIT Madras	1	2001
3.	M. Tech. teaching a course on Engine Design		1993-2008
4.	Ph. D Guidance at IIT Delhi, Studies on Wear of some critical Parts in Diesel Engines Nagaraj Shivappa. Nayak, Centre for energy studies	1	2005
5.	Ph. D Guidance at IIT Delhi, Modelling Diesel Combustion, Yogesh Aghav, Centre for Energy studies	1	2006
6.	B. Tech, M. Tech., VelTech, Chennai, Engine Design and Development		2015-
7.	Mahindra Technical Academy, Chennai, Engine Design and Development		2018-

I. Professional Membership

1.	Society of Automotive Engineers, SAE, USA	1979 -
2.	Combustion Institute India	1994-
3.	ASME, USA	Two years
4.	Elected an active member of the New York Academy of Sciences every year	Till 1997
5.	Fellow, SAE International	2009
6.	Fellow, The Indian National Academy of Engineering (INAE)	2013
7.	Fellow, International Society for Energy and Environment and Sustainability (ISEES)	2018

J. Books

1.	Modelling Diesel Combustion, A book to be published by Springer Verlag, The Netherlands (Book), Second Ed. In 2021	2010
2.	Critical component wear in heavy-duty engines, John Wiley (Book)	2011
3.	Design and Development of Heavy-Duty Diesel Engines (Springer)	2019

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| 4. Thermal Management of Engines for Performance and Emissions | 2021 |
| 5. Modelling Spark Ignition Combustion, Springer Nature | 2024 |

K. Research Publications

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| 1. A Gas Sampling Valve for spark-ignition engines, vol.4, Iranian Journal of Technology | 1976 |
| 2. A Mathematical Model for a 4-stroke Spark Ignition Engine, CSIR Indian Journal of Technology, vol. 15 | 1977 |
| 3. Analysis of fluctuations in gas velocity in Motoring conditions, National Conference on IC Engines and Combustion, Bombay, | 1979 |
| 4. Measurement of pulsating temperature and velocity in an internal combustion engine using an ultrasonic flow meter, <i>J. Physics. E: Scientific Instruments</i> 12, 1053-1058 | 1979 |
| 5. Prediction of Gas Exchange Processes in a Single Cylinder Internal Combustion Engine, Feb-26- March, SAE790359 | 1979 |
| 6. An Ultrasonic flow meter for measurement of Gas Velocity and Temperature in intake and exhaust of an Internal Combustion Engine, Jun3 11- 15, SAE Transactions, 790689 | 1979 |
| 7. New Instrumentation Technique for the Study of Unsteady Gas Exchange Process in Engine Manifolds, Spring Meeting, Central States Section, The Combustion Institute, Apr 9-10, Columbus, Indiana | 1979 |
| 8. Modelling of Combustion in Lean Burn Engines, Symposium on UK Universities and Polytechnics, by Science and Engineering Research Council at Kings College, London, April | 1980 |
| 9. Generalised Procedure for Flame and Combustion Chamber Surface Determination in SI Engines, SAE 821223 | 1982 |
| 10. Interferometric Studies of Vaporising and Combusting sprays, SAE 830244* | 1983 |
| 11. A Model for Adsorption and Desorption of Fuel Vapour by Cylinder Lubricating Oil Films and its Contribution to Hydrocarbon Emissions, SAE 830652 | 1983 |
| 12. A Heat Release Model for Divided Chamber Diesel Engines, SAE 860084 | 1986 |
| 13. Study of Air-Gap Insulated Piston in Naturally Aspirated Small Diesel Engines, CIMAC International, Warsaw | 1987 |
| 14. Effects of injection parameters, fuel quality and ambient on the ignition delay and ambient on the ignition delay and the location of the flame Kernel in a diesel spray in a quiescent chamber, SAE transactions ISSN 0096-736X, 1989, vol. 97 (6), pp. 1464-1475 (15 ref.) | 1989 |
| 15. Design and Development of the new WA series highly rated Diesel Engine, CIMAC International, Tianjin, China | 1989 |
| 16. Universal Mixing Correlations for the Performance and Emission of Open Chamber Diesel Combustion Supported by Air-swirl, SAE 900446 | 1990 |
| 17. Solution to the Vibration Problems of a 3-cylinder Diesel Engine, XII National Conference for IC Engines and Combustion, Dehradun | 1992 |
| 18. Design and Development of a Mechanical Governor for a Large Horsepower Diesel Engine, XIII National Conference on IC Engines and Combustion, Bangalore | 1994 |
| 19. Heat Transfer in Diesel Engines and Estimation of the Lubricating Oil Temperature, Vol. 208, Proceedings of Institution of Mechanical Engineers, IMechE (UK) | 1994 |
| 20. Linear modelling and design of exhaust mufflers for diesel engines, XV National Conference on IC Engines and Combustion, Anna University, Madras | 1998 |
| 21. Design and development of a torsional vibration rubber damper, SAE 990023 | 1999 |
| 22. Solving Inlet valve seat wear problem in high BMEP engines, SIAT 2001, SAE2001-01-0024 | 2001 |
| 23. Generalised boundary conditions for calculating Diesel Pistons, SAE conference in Madras, January 2002 | 2001 |
| 24. Predicting HC emissions from DI Diesel engines, ASME Fall Conference, September 2000 and ASME Transactions 2002 | 2002 |
| 25. Liner wear by extending Kragelskii model, Journal of Tribology, IMechE (London) Vol. 216, Part J | 2002 |
| 26. Accurate prediction of heat release in Direct Injection Diesel Engines, Proceedings of Institution of Mechanical Engineers, Vol. 216, Part D: Journal of Automobile Engineering, IMechE (London) | 2002 |
| 27. Bore polishing wear in diesel engine cylinders – ESDA- 58526, ASME, Manchester UK | 2004 |
| 28. Abrasive wear of Piston grooves of Highly loaded Diesel Engines, ESDA 58520, ASME, Manchester UK | 2004 |
| 29. Two Methods for Improving Torque of a Diesel Engine in the Low-Speed Range - a paper submitted to Symposium on International Automotive Technology, India and Auto-Expo Stuttgart | 2005 |
| 30. Development of Modern Single cylinder High power engine for Agricultural application – SETC 2004, JSAE –52, Graz, Austria | 2004 |
| 31. Prediction of cam follower wear in diesel engines- Paper submitted to 15th International Conference on Wear of Materials- USA – Wear Transaction, Elsevier Publication | 2004 |
| 32. Improving AVL MCC model and implementing in "Boost", International User Conference, Advanced Simulation Technologies, AVL, Graz, Austria | 2005 |
| 33. ICEF2005-1350 Phenomenology of smoke from direct injection diesel engine ASME, USA, presented at IC Engines Spring Conference, Aachen, Germany | 2005 |
| 34. ASME, WTC2005-63599: Studies on Wear of Inlet Valve and Cylinder Bore in Diesel Engines, Nagaraj Nayak, Kirloskar Oil Engines Limited, Pune, Maharashtra-State, India, P. A. Lakshminarayanan, Ashok Leyland, Hosur India, M. K. Gajendra Babu, Indian Institute of Technology, New Delhi, India, A. D. Dani, Kirloskar Oil Engines, Ltd., Pune, India, World Tribology Congress III, September 12–16, 2005, Washington Hilton & Towers, Washington, DC, USA | 2005 |
| 35. ICES 2006-1346 Validating phenomenological smoke model at different operating Conditions of DI diesel engines, ASME, USA, presented at IC Engines Spring Conference Aachen, Germany | 2006 |
| 36. A Case Study on the Application of a Genetic Algorithm for Optimization of Engine Parameters, Proceedings IMechE (London) 2006, D09204, Vol. 220 Part D, Journal of Automobile Engineering | 2006 |
| 37. Finite Element Analysis of Separation of Ring Gear and Flywheel due to over-speed and Heating by Clutch Slip, National Abaqus Users' Conference, Bangalore, 11-Oct-06 | 2006 |
| 38. Engine Noise Mapping and Noise Reduction, Bruel and Kjaer Conference, Bombay, 12 Oct-06 | 2006 |
| 39. Thermodynamic Simulation of Turbocharged Intercooled Stoichiometric Gas Engine, SAE Paper 2008-01-2510 | 2008 |
| 40. CFD simulation of a 171 kW Euro-2 engine, AVL Conference, Pune | 2008 |
| 41. NOx Selective Catalytic Reduction (SCR)-Emission Technology for India, SAE Paper 2009-26-0015 | 2009 |
| 42. Euro-3 Emission Compliant Engine using Low-Pressure Fuel Injection System without Electronics, May, SAE Paper 2010-01-1504 | 2010 |
| 43. A cost-efficient EGR technology equipped with mechanical fuel injection equipment for future off-road diesel engines satisfying advanced emission norms, SAE Paper 2010-01-1958 | 2010 |
| 44. Crankshaft Peak Firing Pressure Bearing Capability Enhancement SAE Paper 2010-01-1527 | 2010 |

45. Transient Simulation of Engines and Vehicles applying 1-D Engine Performance Software; Virtual Power train conference, Pune, 25 May 2010 2010
46. The Introduction of Bharat Stage 4 into the Indian Market, SAE Heavy Duty Diesel Emissions Control, Symposium, 21-22 September in Gothenburg, Sweden 2010
47. Simulation of Engine Transients and Passby Noise- applying 1-D Engine Performance Software, AVL Boost, Advanced Simulation Technologies, Indian User Conference 2010 at Hotel Le Meridian, Pune, 24 November 2010 2010
48. Prediction of the rate of heat release of mixing-controlled combustion in a common-rail engine with pilot and post injections, Journal of Automotive Engineering, IMechE (Lond.); vol. 225, issue 2, pp. 246-259, DOI: 10.1243/09544070JAUTO1615; 1 Feb 2011 2011
49. A Basis for Estimating Mechanical Efficiency and Life of a Diesel Engine from its Size, Load Factor and Piston Speed, 2011-01-2211, Published 09/13/2011 2011
50. Blowby, Breathing and Oil Slobbering from Small Engines, SIAT SAE, 2013-26-0123 2013
51. Transient Thermodynamic Performance and Passby Noise from the Silencer of a Modern Diesel Engine in an Actual Vehicle" SAE Journal of Engines, 2013-01-9045, 2013 2013
52. Estimation of Particulate Matter from Smoke, Oil Consumption and Fuel Sulphur, SAE 2016-32-0066, published: 2016 2016-Nov-08 (presented earlier at CMC Pune, 2014) 2016
53. A New Two Cylinder Diesel Engine Family for Off-road in Naturally Aspirated and Turbocharged Intercooled Versions, SAE 2016-01-2335, published: 2016-Oct-17 2016
54. A Layout for the Hydrogen Engine, Journal of Energy and Environmental Sustainability (accepted) 2023

**Arch T Colwell Merit Award*

L. Design Experience

L.1. Design and Development of Cylinder Head, Ports, Manifolds, Piston Cavity, Combustion System and Matching Fuel Injection Equipment of the following Diesel Engines

	Bore x Stroke x cylinder	Hp	rpm	Emissions	Application	Engine type	year
1.	75 x 76, 1	5	2200	-	Water Pump	WP	1983-85
2.	75 x 76, 1	7.1	3000	-	Generator	GP	1991-94
3.	100 x 110, 2 and 3	22, 23	2000	TREM-1	Tractor Power Unit	RVTMA	1985-87
4.	100 x 120, 2 and 3	46, 30	2300	US Tier-1	Tractor Power Unit	HV2, HV3	1993-94
5.	175 x 220, 4	180	1000	-	Marine	W4ND	1992
6.	110 x 116, 6	127	1500	TREM-1	Gen.-set	RB66TA	1994
7.	105 x 120, 4	80	2500	US Tier-1	Power unit Tractor*, Gen.-set and Earth Mover	4R1040E, 3R1040E	1994-98
8.	105 x 120, 4	110	2500	US Tier-1	Gen.-set and Earthmover	4R1040T, TG	1998-99
9.	105 x 120, 4	135	2500	US Tier-1	Gen.-set and Earthmover	4R1040TA, TAG	1998-99
10.	124 x 130, 1	22.5	2250	US Tier-1	Tractor	1R1600	1999-04
11.	105 x 125, 6	170	1500	US Tier-1	Gen-set	6R1080TAG	1999-00
12.	100 x 110, 3	34	2000	US Tier-1	Tractor*	3R860	2000-01
13.	102 x 120, 3	45	2000	US Tier-1	Tractor	3R980	2000-01
14.	124 x 135, 1	25	2250	US Tier-1	Tractor	1R1600	2000-01
15.	107 x 120, 6	130, 160	2500	Euro-2	Truck	L62D, L62N	2003-04
16.	104 x 113, 6	130, 160, 180	2400	Euro-2	Truck and Bus	HA6DTI2D, HA6DTI2N, HA6DTI2U	2003-04
17.	104 x 113, 6	205	2500	Euro-2	Truck and Bus	HA6DTI2S	2004-05
18.	104 x 113, 6	205	2500	Euro-3	Truck and Bus, Common Rail System	HA6DTI3S	2002-06
19.	104 x 113, 6	185	2500	Euro-3	Truck and Bus, electronic engine	HA6DTI3U	2002-06
20.	104 x 113, 4	120	2500	Euro-3	Truck and Bus, electronic engine	HA4CTI3U	2002-06
21.	104 x 113, 4	120	2500	Euro-3	Trucks and Buses using inline pumps without electronics	HA4CTI3K	2009-10
22.	104 x 113, 6	80	2200	USTier-3	Combine harvester, earthmovers, and backhoe using the inline pump without electronics	HA6DTI	2009-10
23.	104 x 113, 6	136	2200	USTier-3	Combine harvester, earthmovers, and backhoe using the inline pump without electronics	HA6DTI	2009-10
24.	104 x 113, 6	160	2500	Euro-4	Truck and Bus, electronic engine, SCR	HA6DTI4N	2005-10
25.	104 x 113, 6	205	2500	Euro-4	Truck and Bus, electronic engine, SCR	HA6DTI4S	2005-10
26.	104 x 113, 6	230	2500	Euro-4	Truck and Bus, electronic engine, SCR	HA6DT4SS	2005-10
27.	104 x 113, 6	190	2500	Euro-4	Truck and Bus, electronic engine, EGR	HA6DT4ME	2005-10
28.	104 x 113, 6	130	2500	Euro-4	Truck and Bus, electronic engine, SCR	HA4DT4ME	2005-10
29.	104 x 113, 6	230	2500	IMO-1	Marine engine	HA6DTI	2005-10
30.	104 x 113, 6	170.1	1500	CPCB-1	125 kVA Genset	HA6DTI	2010-11
31.	104 x 113, 4	136.1	1500	CPCB-1	100 kVA Genset	HA4DTI	2010-11
32.	104 x 113, 6	217.7	1500	CPCB-1	160 kVA Genset	HA6DTI	2010-11
33.	95 x 91, 2	16.3	1500	CPCB-1	11 kVA Genset	SC213	2011-12
34.	95 x 91, 2	22.0	2200	TREM3A, Tier4	Tractor	SC213	2012-13

35.	95 x 91, 2	25.0	2500	-	Industrial	SC213	2012-13
36.	95 x 91, 2	17.0	1500	-	Industrial	SC213	2012-13
37.	95 x 91, 2	23.1	1500	CPCB-2	15 kVA Genset	SC213TA	2012-13
38.	95 x 91, 2	18.0	1500	CPCB-2	15 kVA Genset	SC213T	2012-13
39.	95 x 91, 2	18.0	1500	CPCB-2	20 kVA Genset	SC213T	2014-16
40.	95 x 127, 3	42.6	2200	TREM3A, Tier4i	Tractor	SJ327TA	2012-13
41.	95 x 127, 4	44.1	2200	TREM3A, Tier4i	Tractor	SJ436TA	2012-13
42.	95 x 127, 4	47.8	2200	TREM3A, Tier4i	Tractor	SJ436TA	2012-13
43.	95 x 127, 4	55.1	2200	TREM3A, Tier4i	Tractor	SJ436TA	2012-13
44.	95 x 127, 4	60.3	2200	TREM3A, Tier4i	Tractor	SJ436TA	2012-13
45.	100 x 127, 4	73.5	2200	EU Stage2	Tractor	B X 200TA	2013-14
46.	95 x 91, 2	22	2200	TREM3A, Tier4f	Tractor	SC213TA	2013-14
47.	100x127, 4	90	2200	Tier2	Tractor	ST440TA E1	2015
48.	100x127, 4	100.5	2200	Tier2	Tractor	ST440TA E2	2016
49.	95 x 91, 2	35	2500	TREM3A, Tier4i	Tractor	SC213TA	2016-17
50.	100 x 95, 1	17	2800	TREM3A, Tier4f	Tractor	SC108	2016-17
51.	100x127, 4	110	1500	CPCB2	82.5 kVA Genset	ST440TA	2018

The engines shaded above received the best innovative product award (**Golden Peacock**) from the Institute of Directors, India in January 2000

* Certified by the EPA for US-Tier1

L.2. Design, Development and Testing of dual fuel and Gas Engines

	Bore x Stroke x cylinder	Hp x rpm	Application	Engine type	year
1.	175x220, 4 and 6	400x1000, 600x1000,	Power Generation running on Natural Gas and Bio Gas in dual fuel mode	W4ADG and W6ADG	1993-95
2.	110x116, 6	105x1500	Power Generation	RB66T (Gas)	1993-94
3.	175x220, 4	600x1500	Power Generation	24AG-1500	1995-96
4.	105x120, 4	82x2700	Truck, Multipoint fuel injection system with Bosch platform	4R1040C	2000-01
5.	104x113	150x2500	4-cylinder-Truck and Bus, electronic engine, with 3-way catalyst, multipoint fuel injection	Euro-6 (EEV)	2009
6.	104x113	180x2500	6-cylinder-Truck and Bus, electronic engine, with 3-way catalyst multipoint fuel injection	Euro-6 (EEV)	2010
7.	104x113	130x2500	6-cylinder-Truck and Bus, electronic engine, with 3-way catalyst, single point fuel injection	Euro-6 (EEV)	2010
8.	104x113	144x2500	4-cylinder-Truck and Bus, electronic engine, with 3-way catalyst, multipoint point fuel injection	Euro-6 (EEV)	2010
9.	104x113	125x2500	4-cylinder-Truck and Bus, electronic engine, with 3-way catalyst, multipoint point fuel injection	Euro-6 (EEV)	2010
10.	104x113	124 kVA, 50 Hz	6-cylinder-TCIC engine with low-pressure gas control	Euro-6 (EEV)	2011

L.3. Design and Development of Full Diesel Gensets

	KVA	Hz	Application	year
1.	10	50	Power Generation	2017
2.	50	50	Power Generation	2017
3.	62.5	50	Power Generation	2018

L.4. Design, Development and Testing of Turbine expander cooler

	Flow rate x pressure	Application	year
1.	150 cfm x 7 kg/cm ²	Turbine expander for cooling military aircraft on the ground	1992
2.	300 cfm x 7 kg/cm ²	Turbine expander for cooling military aircraft on the ground	2001

L.5. Design, Development and Testing of Mechanical Governors for large hp Engines

	Bore x Stroke x cylinder	Hp x rpm	Application	Engine type	year
1	175x220, 4 and 6	400x100060 0x1000	Power Generation (Turbocharged, air-to-water after-cooled)	WA	1992
2	RSV governor for a single-cylinder engine	25x2250	Tractor	1R1600	2001

L.6. Design, Development and Testing of Crankshaft Dampers

	Bore x Stroke x cylinder	Hp x rpm	Application	Damper type	Engine type	year
1.	175x220, 4	600x1500	Power Generation	Spring and mass	WA (1500)	1992
2.	110x116, 6	105x1500	Power Generation	Rubber type	RB66T	1992
3.	118x135, 6	240x2200	Power Generation and Truck	Rubber type	6SL9088TA	1998
4.	105x125	210x2500	Compressor	Rubber type	6R1080TA	2000
5.	113 x 127	260 x2500	truck	viscous	J8.08	2006
6.	104 x113	180 x2400	truck	rubber	HA6DTI2D HA6DTI2N HA6DTI2U	2005

L.7. Design, Development and Testing of Water Pump, special air-to-air Intercoolers, canopies and vibration control

	Bore x Stroke x cylinder	Hp x rpm	Engine type	Component	Feature	year
1.	175x220, 4	600x1500	WA (1500)	Fresh Water Pump		1992
2.	105x120, 4, 6	80-210x2500	4R1040, 6R1080	Fresh water pump		1995
3.	110x116, 3	50x2000	RB33	Noise Reduction	By 10 dBA	1991
4.	110x116, 6	127x1500	RB66TA	Air-to-air Intercooler	90%Effectiveness, For the first time in India in Aluminium Construction	1994
5.	75x76	7.1x300	GP	Canopy	Less noise, and no Auxiliary fan to keep the canopy cool	1992
6.	104x113	180x2500	Truck	Water pump	Improved cooling	2002

L.8. Design and Development of Instruments

	Instrument	Feature	Year
1.	Torque-meter to measure 70 hpx4000 rpm	Strain-gage type to measure dynamic torque	1971
2.	Cyclic Irregularity meter	Uses a Z80 Microprocessor – picks up starter gear teeth and works out instantaneous velocity and hence cyclic irregularity	1985
3.	Torsional Vibration Meter	Uses Analogue circuits. Based on the Fourier series of square pulses arriving at variable frequency. Integrates t the torsional oscillation twice.	1987
4.	Electrical Analogue of Pistons	Electrical Analogue of the thermal field in the piston reveals the temperature distribution in pistons	1986
5.	Camera	To get interferograms of diesel spray obtained using double-exposure laser holographic interferometry. This special camera can take photographic prints of holograms focused at infinity	1979
6.	Crank Angle Selecting Unit	At the selected crank angle it produces an electrical pulse to trigger instruments and devices	1978
7.	Accurate Electronic clock	Least count 200 n-second	1978
8.	Ultrasonic flow and temperature meter	Measures transient temperature up to 1000 K, and velocity up to 250 m/s simultaneously in the exhaust and inlet manifolds to calculate available energy to the turbochargers.	1978
9.	Closed-circuit engine cooling	To conserve cooling water and additive...Reduced losses to 1 litre per 600 hours	2002
10.	Development of Damper testing rig		2004
11.	Crankshaft testing rig	For testing the bending fatigue strength of the crankshaft	(2006)

M. Design Software or procedures developed

	Software or Procedure	Feature	Year
	Matching turbochargers	Enables selection of turbochargers first time correctly matched	1987
	Cams	Design of harmonic inlet and exhaust cams for diesel engines	1988
	Available energy	Predicts the energy available in the exhaust for useful work, and the volumetric efficiency and inlet depression	1978
	Emissions	Calculates and predicts HC emissions from Spark Ignition Engines	1982
	Emissions	Predicts HC emissions from Diesel Engines	1999

N. Knowledge of Software

Higher languages	Basic, Fortran, Turbo-C
Assembler	Z80, 8085, 6800
Finite element	Cosmos-M, Abaqus, Ansys
CAD	AutoCAD, Auto-Lisp, Solid-Works, Pro/E Wildfire
CAM	M and G codes
Instrumentation	National Instruments
Thermodynamics	EC Diesel, Boost
Crankshaft and bearings	Excite Designer

O. Patents

	Patents		Appl. No
1.	Farmer-friendly washable but highly efficient air filter for tractor engines		
2.	USTier-3 engine using inline fuel injection pump without electronics		
3.	Euro-3 engine using inline fuel injection pump without electronics		
4.	A System and method for reducing fuel consumption by controlling engine idling time	18/05/2005	594/CH E/2005
5.	A method to determine the damping coefficient of a Viscous Damper used in Diesel Engine	2007	Applied
6.	Boost Pressure On-Off valve for vehicle limp-home device	19/12/2007	3052/CH E/2007
7.	Method to prevent overheating on indigenous nozzles	2007	Applied
8.	Dual Voltage Alternator System	25/06/2008	1544/CH E/2008
9.	New Exhaust Gas Re-circulation (EGR) System for IC Engines	10-08-2009	2447/CH E/2009
10.	EURO3 or BS3 diesel engines with mechanical inline Fuel Injection Pumps without electro-controlling devices	30/10/2009	2646/CH E/2009
11.	High Pressure-filtered EGR system with low-pressure fuel injection	06-11-2010	1632/CH E/2010

P. Additional Professional Activities

1. Teaching M. Tech (Automotive Engineering) as a visiting faculty at the Indian Institute of Technology, Madras
2. Guidance to Pune and Madras Universities M. E. Students regularly till 2009
3. Guiding two PhD students at the Indian Institute of Technology, New Delhi
4. Examination of Ph. D. Theses from Indian Institute of Technology, New Delhi, VIT –Vellore, Pune University
5. Widely travelled for learning, solving problems, and interacting with customers and suppliers and intellectuals.
6. Teaching at Mahindra Technical Academy, Chennai
7. Teaching at IIT Kanpur
8. PIP programmes at SAE India and SAE (intl.)

Q. Languages

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|------------|-----------------------|
| 1. Tamil | Read, write and speak |
| 2. English | Read, write and speak |
| 3. German | Read and speak |
| 4. French | Read |
| 5. Hindi | Read, write and speak |
| 6. Marathi | Read and speak |