

Combustion Gasification & Propulsion Laboratory

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Academic Qualification

B.E.Mechanical (I Class III Rank), 1963, NIE, Mysore University, Mysore, India
M.E (Aeronautical): I Rank, 1965, Indian Institute of Science, Bangalore, India
Ph.D (Engineering Sciences), 1970, Indian Institute of Science, Bangalore, India

Teaching

About half a dozen courses in the areas of Rocket Propulsion, Liquid Propellant Rockets, Aircraft as a total system, Mechanics and Thermodynamics of Aerospace Propulsion, Mathematical Techniques in Reacting Flows, Fundamentals of Combustion, Statistics and Probability in Missile Kill phenomena have been developed from current literature and delivered over the last twenty years of teaching. Some of the courses have been delivered over several years and have helped consolidate ideas for writing graduate level books on Combustion and Aerospace Propulsion.

Scientific Contributions

Scientific contributions are in the areas of modeling of combustion in hybrid rocket engines and solid propellants and ingredients; combustion of liquid droplets and instability in liquid rocket engines; of propagation of premixed flames with complex chemistry and diffusion; of reacting flows in nozzles and

air inlets in aircraft and missiles; of combustion of wood in gasifiers and in stoves; of heat transfer in nuclear reactor system and large pressure vessels of petrochemical complex.

Recognitions

- Fellow of Indian Academy of Sciences in 1984
- Fellow of the Indian National Academy of Engineering in 1994
- Om Prakash Bhasin Award for contributions to Science and Technology in Energy, 1994;
- Alumni award for excellence in Research in Engineering, 1994.
- KSIIDC Chair, 1993-1996
- Co-chairman of Committee on research and Development on Biomass Gasification and Combustion, Ministry of Non-conventional Energy Sources 1985- 1991

Administrative Positions held

1. Convener, Space Technology Cell (1982-1983)
2. Convener, Joint Advanced Technology Programme (1983-1987)
3. Chairman, Centre for Scientific and Industrial Consultancy (1989-1991)
4. Convener, Action Research centre for Biomass Gasification and Combustion
5. Hon. Secretary, KSCST (1995+)
6. Chairman, Department of Aerospace Engineering (1995 - 2000)

Books

1. H. S. Mukunda, Understanding Combustion, MacMillan India Ltd, 1990
2. H. S. Mukunda, S. Dasappa, U Shrinivasa, Open Top Wood Gasifiers, pp 699-728, A Chapter in "Renewable Energy, sources for fuels and electricity", Island Press, 1993
3. Editor (with Prof. A. V. Krishnamurty) of the Proceedings of the International Symposium on Recent Advances in Aerospace Sciences and Engineering, 1992
4. Co-Editor (with Prof. P. J. Paul) of the Proceedings of the Fourth National Meet on Recent Advances in Biomass Gasification and Combustion, 1993
5. H. S. Mukunda, Understanding Aerospace Chemical Propulsion, Interline Publishing, India, 2004

Refereed Journals

1. V.K. Jain and H.S. Mukunda, On Ignition and Extinction Problems in Forced Convection Systems, *Int. J. Heat Mass Transfer*, 11, p.419, 1968.
2. H.S. Mukunda and V.K. Jain, Structure of a Diffusion Flame in the Presence of a Wall with One Step Reversible Chemical Kinetics, *Astronautica Acta*, 14, p.629, 1969.
3. V.K. Jain and H.S. Mukunda, The Extinction Problem in an Opposed Jet Diffusion Flame with Competitive Reactions, *Combustion Science and Technology*, 1, p.105, 1969.
4. H.S. Mukunda, Effect of Interaction between Chemical Kinetics and Fluid Mechanics in a Stagnation Point Boundary Layer, *Combustion Science and Technology*, 3 p-267, 1971.
5. H.S. Mukunda, Evaluation of Some Definite Integrals Involving Repeated Integrals of Error Function, *Bulletin of Calcutta Math Soc*, 66, p.39, 1974.
6. H.S. Mukunda, S.M. Deshpande, H.R. Nagendra, A. Prabhu, S.P. Govindaraju, A Critical Study of the Work 'Vyamanika Shastrai, *Scientific Opinion*, p.5, 1974.
7. H.S. Mukunda and B.N. Raghunandan, Burning Constant Stoichiometry Ratio Relation - Some Clarifications, *AIAA JI*, 12, p.1430, 1974.
8. H.S. Mukunda and B.N. Raghunandan, Rocket Propellant Combustion Studies in a Constant Volume Bomb, *Combustion Science and Technology*, 9, p.149, 1974.
9. B.N. Raghunandan and H.S. Mukunda, Transient Processes in Liquid Droplet Combustion, *Letters in Heat Mass Transfers*, 3, p.213, 1976.
10. B.N. Raghunandan and H.S. Mukunda, Liquid Droplet Combustion - A Re-examination, *Combustion and Flame*, 30, p.71, 1977.

11. A.G. Marathe, H.S. Mukunda and V.K. Jain, Some Studies on Hydrogen-Oxygen Diffusion Flame, *Combustion Science and Technology*, 15, p. 49, 1977.
12. B.N. Raghunandan and H.S. Mukunda, Combustion of Polystyrene Spheres in Air, *Fuel*, 56, p. 271, 1977.
13. H.S. Mukunda, A. Subhananda Rao, A.M. Sadhashiva Rao, Flow Studies in Non-circular Tubes with Wall Injection, *Combustion Science and Technology*, 15, p. 21, 1977.
14. H.S. Mukunda, V.K. Jain and P.J. Paul, A Review of Hybrid Rockets - Present Status and Future Potential, *Proc. Indian Acad. Sci*, C2, Part I, May 1979, 21, pp.215, 1977.
15. H.S. Mukunda, A Comprehensive Theory of Erosive Burning in Solid Propellants, *Combustion Science and Technology*, 18, p.105, 1978.
16. P.J. Paul, H.S. Mukunda, H.K. Narahari and V.K. Jain, Regression Rate Studies in Hypergolic Systems, *Combustion Science and Technology*, 26, pp.17-24, 1981.
17. P.J. Paul, H.S. Mukunda and V.K. Jain, Regression Rates in Boundary Layer Combustion, *Proc. 19th International Symposium on Combustion*, pp. 717-729, 1982.
18. P. Ram Prasad, B.N. Raghunandan and H.S. Mukunda, Some Experiments on Model Composite Solid Propellants, *Propellants, Explosive and Pyrotechnics*, 8, pp. 53-55, 1983.
19. U. Shrinivasa and H.S. Mukunda, Wood Gas Generators for Small Power Requirements, *Current Science*, November 1983.
20. U. Shrinivasa and H.S. Mukunda, Wood Gas Generators for Small Power (5HP) Requirements, *Sadhana, Proceedings of the Indian Academy of Sciences*, I, pp.137-154, 1984.
21. H.S. Mukunda, P.J. Paul, U. Shrinivasa and N.K.S. Rajan, Combustion of Wood Spheres - Experiments and Model Analysis, *Proceedings of the 20th Symposium (International) on Combustion*, 1984.

22. H.K. Narahari, H.S. Mukunda and V.K. Jain, A Comprehensive Model for the Combustion of Ammonium Perchlorate, Proceedings of the 20th Symposium (International) on Combustion, pp.2073-2082, 1984.
23. S. Dasappa, V. Reddy, H.S. Mukunda and U. Shrinivasa, Experience with Gasifiers for 3.7 kW Engines, AMBIO, pp. 275-279, 1985.
24. A.T. Bhashyam, S.M. Deshpande, H.S. Mukunda and G. Goyal (1986), A Novel Operator Splitting Technique for One Dimensional Laminar Flames, Combustion Science and Technology, 46, Vol. 46, pp.223-248, 1986.
25. M.S. Hegde, P.J. Paul, and H.S. Mukunda, Free Convective Combustion on Vertical Surfaces - Variable Property Analysis and Experiments, Proc. 20th International Symposium on Combustion, 1986.
26. H.S. Mukunda, S.M. Deshpande, A.T. Bhashyam, New Formulation for One Dimensional Premixed Flames, AIAA, JI, 24, pp. 1127-1128, 1986.
27. K.N. Lakshmisha, P.J. Paul, N.K.S. Rajan, G. Goyal and H.S. Mukunda, Behaviour of Methane-Oxygen-Nitrogen Mixtures Near Flammability Limits, Proceedings of the 22nd International Symposium on Combustion, pp 1573-1578, 1988.
28. H.S. Mukunda, U. Shrinivasa, S. Dasappa, S.B. Sunil Kumar, SWOSTHEE - Portable Single Pan Wood Stoves of High Efficiency for Domestic use, Sadhana, J.I.A.Sc, 13, pp. 237-270, 1988.
29. G. Goyal, P.J. Paul, H.S. Mukunda and S.M. Deshpande, Time Dependent Operator Split and Un-split Schemes for One Dimensional Flames, Combustion Science and Technology, 60, pp. 167-189, 1988.
30. H.S. Mukunda, Variable Property Analysis - Is there anything to it? Sadhana, J.I.A.Sc, 12, Parts 1 & 2, pp. 87-199, 1988.
31. S. Dasappa, U. Shrinivasa, B.N. Baliga and H.S. Mukunda, Five--kilowatt Wood Gasifier Technology: Evolution and Field Experience, Sadhana, J.I.A.Sc, 14, pp.187--212, 1989.

32. L.T. Chitilapilly, S. Venkateswaran, P.J. Paul and H.S. Mukunda, Flow Measurements in a Model Ramjet Secondary Combustion Chamber, *Jl. Propulsion and Power*, v. 6, pp 727--732, Nov-Dec 1990.
33. K. N. Lakshmisha, P. J. Paul, H. S. Mukunda, On the flammability limit and heat loss in flames with detailed chemistry, *Proceedings of the 23rd symposium (international) on Combustion*, pp 433--440, 1990.
34. Sekar, B, and H. S. Mukunda, A computational study of direct simulation of high speed mixing layers without and with chemical heat release, *Proceedings of the 23rd symposium (international) on Combustion*, pp 707-713, 1990.
35. R. Balu, A.G. Marathe, P.J. Paul and H.S. Mukunda, Analysis of performance of a Hot-gas injection thrust vector control system, *Jl. Propulsion and Power*, pp 580-585, v. 7, July-August 1991.
36. G. Goyal, P.J. Paul, H.S. Mukunda, Computational studies on One-Dimensional laminar premixed on H₂-NO Flames, *Combustion and Flame*, v. 88, pp 28--36, 1992.
37. S. N. Srinivas, N. H. Ravindranath, S. Dasappa, and H. S. Mukunda., Wood gasifier based rural power generation system: A case study, *Pacific and Asian Journal of Energy*, v. 2, No. 2, pp 81--91, Dec 1992.
38. B. N. Baliga, S. Dasappa, U. Shrinivasa, and H. S. Mukunda., Gasifier-based Power Generation: Technology and Economics, *Sadhana*, v. 18, pp 57--75, March 1993
39. H. S. Mukunda, Stretch effects in high speed reacting mixing layers, 89, p. 285--290, *Combustion Science and Technology*, 1993
40. H. S. Mukunda, S. Dasappa, S. Bhogle, U. Shrinivasa, Studies on Stove for Powdery biomass, *Int. J. Energy Research*, v. 17, pp 281--291, June 1993
41. H. S. Mukunda and J.P. Drummond, Two-Dimensional Linear Stability of Laminar Flames, *Applied Scientific Research*, 51, pp 687-911, 1993

42. Sangeeta Kohli, J Srinivasan, and H. S. Mukunda., Heat Transfer to a horizontal disc using a buoyancy induced jet, *Int. J. Heat Mass Transfer*, v. 36, No. 16, pp. 4049--4066, 1993
43. S. Dasappa, P.J. Paul, H. S. Mukunda, and U Shrinivasa, Gasification of wood-char spheres in CO₂-N₂ mixtures—Analysis and Experiments, *Chemical Engineering Science*, v. 49, No. 2, pp. 223--232, 1993
44. D. P. Mishra, P.J. Paul, H. S. Mukunda, Stretch effects extracted from inward and outward propagating spherical flames, *Combustion and Flame*, v. 97, pp 35--47, 1994
45. D. P. Mishra, P.J. Paul, H. S. Mukunda, Stretch effects extracted from propagating spherical premixed flames with detailed chemistry, *Combustion and Flame*, p 379--386, 1994
46. S. Dasappa, H. V. Sridhar, P. J. Paul, and H. S. Mukunda, On the combustion of wood char spheres in O₂/N₂ mixtures - Experiments and Analysis, *Proceedings of the 25th symposium (international) on Combustion*, pp 569--576, 1994.
47. H. S. Mukunda, S. Dasappa, P. J. Paul, N. K. S. Rajan, and U. Shrinivasa., Gasifiers and combustors for biomass - technology and field studies, *Energy for Sustainable Development*, v. 1, pp 27--38, 1994.
48. H. S. Mukunda, P. J. Paul, S. Dasappa, U. Shrinivasa, N. K. S. Rajan, H. Sharan, R. Beuhler, P. Hasler and H. Kaufmann., Results of an Indo-Swiss Programme for Qualification, and Testing of an 300 kW IISc-Dasag Gasifier, *Energy for Sustainable Development*, v. 1, pp 46-49, 1994.
49. G. Sridhar, H. V. Sridhar, S. Dasappa, P. J. Paul, N. K. S. Rajan, U. Shrinivasa, H. S. Mukunda., Technology for gasifying pulverised biofuels including agricultural residues, *Energy for Sustainable Development*, pp. 9--18, v.III, no. 2, 1996.

50. H. S. Mukunda, and P. J. Paul., Universal behaviour of the erosive burning behaviour in solid propellants, *Combustion and Flame* v. 109, pp 224--236, 1997
51. H. Sharan, H. S. Mukunda, U. Shrinivasa, S. Dasappa, P. J. Paul, N. K. S. Rajan, IISc--DASAG Biomass Gasifiers: Development, Technology, Experience and Economics, *Developments in Thermochemical Biomass Conversion*, pp 1045--1057, Blackie Academic and Professional (Pub), 1997
52. H. S. Mukunda, S. Dasappa, P. J. Paul, N. K. S. Rajan, U. Shrinivasa, G. Sridhar, and H. V. Sridhar., Fixed bed gasification for electricity generation, *Biomass Gasification and Pyrolysis, State of the art and future prospects*, pp. 105--116, European Commission, CPL Press, 1997.
53. M. Jayamurthy, S. Dasappa, P. J. Paul, G. Sridhar, H. V. Sridhar, H. S. Mukunda, N. K. S. Rajan, C Barge, T Liliedahl, K. Sjostrom., Tar characterisation in new generation agro-residue gasifiers--cyclone and downdraft open top twin air entry systems, *Biomass Gasification and Pyrolysis, State of the art and future prospects*, pp. 235--248, European Commission, CPL Press, 1997.
54. Sangeeta Kohli, J. Srinivasan and H. S. Mukunda., Modelling of buoyancy-induced flow and heat transfer in a biomass stove, *Fourth National J. Energy, Heat and Mass Transfer*, v. 19, 167-178, 1997

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Proceedings in International Conferences

1. B.N. Raghunandan and H.S. Mukunda, Liquid Droplet Combustion, A Re-examination, Abstracts of 16th Symposium (International) on Combustion, 1976.
2. R.K. Raut, H.S. Mukunda, and V.K. Jain, Erosive Burning Characteristics of solid Propellant Rocket Motors, Paper 78-1097, AIAA/SAE, 14th Propulsion Conference, Las Vegas, USA.
3. A.T. Bhashyam, H.S. Mukunda, S.M. Deshpande and M.R. Ananthasayanam, Monte Carlo Techniques in Premixed Flows, Proc. First Asian Congress on Fluid Mechanics, December, 1980.
4. B.N. Raghunandan, A. Vidyarthi, H.S. Mukunda, P.J. Paul, Fluid Flow Studies on Radial Injectors in Liquid Rocket Engines, Proceedings of the Second Asian Congress on Fluid Mechanics, Beijing, China, October 2-30, 1983.
5. H.S. Mukunda, Numerical Treatment of Propagating One Dimensional Laminar Flames - Invited paper presented at the International Conference on Computational Mechanics, May 1986, Japan.
6. S. Dasappa, V. Reddy, H.S. Mukunda and U. Shrinivasa, Wood Gasifiers for Engines less than 7.5 kW, Proc. 7th Miami International Conference on Energy, Dec 1985.
7. A.G. Marathe and H.S. Mukunda, Euler Flow Computation of Axisymmetric Mixed Flow Inlet, Proc. of International Conference on Computational Mechanics, XI-65-69, 1986.
8. S. Dasappa, U. Shrinivasa, B.N. Baliga and H.S. Mukunda, Towards a Viable Technology for Gasifiers : Development and Field Experience, Proceedings of the Third International Conference on Small Engines and their Fuels for use in Rural Areas, University of Reading, UK, 1990.
9. N. K. S. Rajan, H. S. Mukunda, and P. J. Paul., Internal Flow with Free Convection in Large Spherical Vessels - Computation and

Experiments, Proc. Sixth Asian Congress on Fluid Mechanics, pp 586--589, May 1995.

Proceedings in National Conferences

1. H.S. Mukunda, N. Ramani and A.G. Marathe, Analysis of the Variation of Thermodynamic and Transport Properties Flames, First National Heat and Mass Transfer Conference, Madras, 1971.
2. H.S. Mukunda and A.G. Marathe, Some Uncommon Facts in Combustion Theory and Practice, Symposium on Gas Turbine Technology, Bangalore 1973.
3. A.G. Marathe and H.S. Mukunda, On Some Features of Combustion in Premixed and Diffusion Flame Systems, Symposium of Gas Turbine Technology, Bangalore, 1973.
4. A.G. Marathe and H.S. Mukunda, Diffusional Effects in an Opposed Jet Diffusion Flame, HMT-66-75, 3rd Heat and Mass Transfer Conference, December 1975, Bombay.
5. H.S. Mukunda, Evaluation of Erosive Burning Characteristics of Solid Rocket Propellants, Paper presented at the Missile Seminar, Bangalore, 1977 (S).
6. B.N. Raghunandan, V.K. Jain and H.S. Mukunda, Some Studies on Solid Rocket Propellants Rockets, Proceedings of the Second Conference on Propulsion, GTRE, Bangalore, Nov. 1977.
7. B.N. Raghunandan and H.S. Mukunda, Combustion of Polymer Spheres, Paper presented at the Rocket Propulsion Symposium, Institute of Armament Technology, Pune, 1978.
8. A.K. Sehra, H.S. Mukunda and M. Sambashiva Rao, Studies of Erosive Burning in Solid Propellants, Paper presented at the Rocket Propulsion Symposium, IAT, Pune, 1978.
9. P. Ramprasad, H.S. Mukunda and B.N. Raghunandan, A Critical Study of BDP Model and its Extension to Composite Propellant Combustion,

Paper presented at the Rocket Propulsion Symposium, IAT, Pune, 1978.

10. H.K. Narahari, H.S. Mukunda and V.K. Jain, A New Theory for the Self Deflagration of AP, Paper presented at the Rocket Propulsion Symposium, IAT, Pune, 1978.
11. P.J. Paul, H.S. Mukunda and V.K. Jain, A Study of the Low Frequency Instability in Hybrid Rocket Engines, Paper presented at the Rocket Propulsion Symposium, IAT, Pune, 1978.
12. V.L. Nandakumar, A.S.N. Sarma, H.S. Mukunda, B.N. Raghunandan and V.K. Jain, Low Pressure and Temperature Effects on Ignition Delay in Hybrid Hyperbolic System, Paper presented at the Rocket Propulsion Symposium, IAT, Pune, 1978.
13. T. Venkateswara Rao, H.S. Mukunda and V.K. Jain, A Study of Heat Transfer in Regeneratively Cooled Passages in Liquid/Hybrid Rocket Engine, Paper presented at the Rocket Propulsion Symposium, Institute of Armament Technology, Pune, December 1978.
14. H.S. Mukunda and S.K. Taneja, Modelling of Straight Flow Liquid Rocket Combustion Chamber, Paper presented at the Rocket Propulsion Symposium, Institute of Armament Technology, December 1978.
15. P.J. Paul, V.K. Jain, H.S. Mukunda and M. Chanda, Studies on the Hybrid Rocket Motor, Proc. Fourth Seminar on Gas Turbines, pp. 259-264, November 1979.
16. P.J. Paul, T. Venkateswara Rao, H.K. Narahari, A.S.N. Sarma, H.S. Mukunda and V.K. Jain, Studies on the Development of Hybrid Propulsion System, Proc. Fourth Seminar on Gas Turbines, pp. 241-258, November 1979.
17. Raghunandan, H.S. Mukunda and V.K. Jain, Studies on Dihydroxyglyoxime Based Cool Propellants, Proc. Fourth Seminar on Gas Turbines, pp. 265-271, November 1979.

18. H.S. Mukunda, U. Shrinivasa and B.N. Raghunandan, Waste Heat Recovery in Metal Melting and Handling Industries, Proc. of the Workshop on Energy Conservation in Foundries and other Industries, November 1982.
19. H.S. Mukunda, P.J. Paul and H.K. Narahari, Integral Ram Rockets (IRR's), Problems and Prospects, Presented at the Specialist Workshop on Integral Ram Rocket, Hyderabad, India, September 1983.
20. A.K. Sircar, U. Shrinivasa and H.S. Mukunda, The Combustion of Wood Spheres, Proceedings of the 8th National Conference on IC Engines and Combustion, Trivandrum, Dec 1983.
21. H.S. Mukunda, Current Status and Problem Areas of Research in Rocket Propulsion, (Invited Paper) Proc. of the 9th National Conference on IC Engines and Combustion, Dehradun, November 1985.
22. S. Dasappa and H.S. Mukunda, Combustion of Cylinders and Vertical Plates of Wood, Proc. of 9th National Conference on IC Engines and Combustion, Dehradun, p. 1-5, 1985.
23. J.P. Drummond and H.S. Mukunda, A Numerical Study of Mixing Enhancement in Supersonic Reacting Flow Fields, AIAA-88-3260, AIAA/ASME/SAE/ASEE 24th Joint Propulsion Conference, Boston, July 1988.
24. H.S. Mukunda and H.K. Narahari, Reaction Parameters for the Combustion of Monopropellants (AP), AIAA-88-3251, Ibid.
25. H.S. Mukunda, P.J. Paul and H.K. Narahari, 'Integral Ram Rockets (IRR's) - Problems and Prospects, Presented at the Specialist Workshop on Integral Ram Rocket, Hyderabad, India, September 1983.
26. J.P. Drummond and H.S. Mukunda, Mixing Enhancement in Two-Dimensional shear layers, 24th AIAA-ASME Joint Propulsion Conference, July 988, Boston, USA; also NASA TM 1033, 1988.
27. H.S. Mukunda and J.P. Drummond, Two-Dimensional Stability of Laminar Flames, NASA TP 3131, Feb 1992.

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29. H.S. Mukunda, S. Balu, M. Carpenter, J.P. Drummond and A. Kumar, Studies in Direct Simulation of High Speed Mixing Layers, NASA TP in progress.
30. H. S. Mukunda, Modelling Combustion of Solid Propellants - Three decades of effort - A Personal View, Invited talk at the Sixth National Seminar on High Energy Materials, Feb, 1992
31. D. P. Mishra, P. J. Paul and H. S. Mukunda, Flame speed of wood gas at ambient and engine operating conditions, Third National Conference on Biomass Gasification, Baroda, Nov 1991.
32. S. Dasappa, P. J. Paul, H. S. Mukunda and U. Shrinivasa, On the modelling of gasification of char spheres with Carbon dioxide, Carbon monoxide, and Nitrogen, Third National Conference on Biomass Gasification, Baroda, Nov 1991.
33. H. S. Mukunda, P. J. Paul, U. Shrinivasa, S. Dasappa, and K. Krishna Kant, Development of Powdery Biomass Gasifiers, Third National Conference on Biomass Gasification, Baroda, Nov 1991.
34. S. N. Srinivas, N. H. Ravindranath, S. Dasappa, and H. S. Mukunda., A gasifier based rural power generation system: Performance and Problems, Third National Conference on Biomass Gasification, Baroda, Nov 1991.
35. N. K. S. Rajan, C. M. Crasta, V. Gayathri, and H. S. Mukunda., On-line diesel flow measurement system for wood gasifier in a dual fuel mode, Third National Conference on Biomass Gasification, Baroda, Nov 1991.
36. S. N. Srinivas, N. H. Ravindranath, S. Dasappa, and H. S. Mukunda., A gasifier based rural power generation system: Performance and Problems, Third National Conference on Biomass Gasification, Baroda, Nov 1991.

37. H. V. Sridhar, S. Dasappa, P. J. Paul, H. S. Mukunda and U. Shrinivasa., On the combustion of wood-char spheres in vitiated air-analysis and experiments, Fourth National Conference on Biomass Gasification, Mysore, Jan 1993.
38. Purandar Chakravarty, D. P. Mishra, P.J. Paul, and H. S. Mukunda., The theoretical calculations of the limits of flame propagation for producer gas mixture, Fourth National Conference on Biomass Gasification, Mysore, Jan 1993.
39. Shrikant Kanitkar, Purandar Chakravarty, P. J. Paul and H. S. Mukunda., The flame speeds, temperature and limits of flame propagation of producer gas-air mixtures - experimental results, Fourth National Conference on Biomass Gasification, Mysore, Jan 1993.
40. Sangeeta Kohli, J. Srinivasan and H. S. Mukunda., Analysis of buoyancy-induced flow and heat transfer in a biomass stove, Fourth National Conference on Biomass Gasification, Mysore, Jan 1993.
41. G. Sridhar, G. A. Rakesh, J. Srinivasan, S. Dasappa, P. J. Paul and H. S. Mukunda., Experimental studies on the performance of Hamara ST-5 stirling engine and possibilities for performance improvement, Fourth National Conference on Biomass Gasification, Mysore, Jan 1993.
42. V. Manjunath, Colin M. Crasta, V. Gayathri, N. K. S. Rajan and H. S. Mukunda, Biomass utilization via combustion and gasifiers - A computer based video presentation, Fourth National Conference on Biomass Gasification, Mysore, Jan 1993.
43. H. S. Mukunda, Supersonic mixing layers and jets, Invited paper presented at the Symposium on the developments in fluid dynamics and aerospace engineering, Dec. 1993.
44. H. S. Mukunda, P. J. Paul., Fundamental combustion and gasification problems of biomass and biomass derived gaseous fuels, Invited

- paper, pp. 109--117, Proceedings of the First ISHMT-ASME Heat and Mass Transfer Conference, Jan 1994.
45. K. N. Lakshmisha, P. J. Paul and H. S. Mukunda., Computational studies of Hydrogen/air flames near rich flammability limits, pp. 763--769, Proceedings of the First ISHMT-ASME Heat and Mass Transfer Conference, Jan 1994.
 46. D. P. Mishra, P. J. Paul, and H. S. Mukunda., Computational studies on the flame propagation in producer gas-air mixture and experimental comparisons, pp. 256--262, Proc. 13th National conference on IC engines and combustion, Jan 1994.
 47. D. P. Mishra, P. J. Paul, and H. S. Mukunda., Computational studies of the effects of ambient parameters on stretched H₂ air premixed flames with detailed kinetics, pp. 277--283, Proc. 13th National conference on IC engines and combustion, Jan 1994.
 48. H. S. Mukunda, Supersonic ramjets - some insights, Seminar on propulsion, Astronautical Society of India, Trivandrum, Jan 1994.
 49. N. K. S. Rajan, H. S. Mukunda, and A. K. Garg., Numerical prediction of solid propellant regression of a two-dimensional arbitrary grain geometry, Proc. Airbreathing engines and Aerospace propulsion, v. II, pp 449--461, Dec 1994
 50. D. P. Mishra, P. J. Paul, and H. S. Mukunda., Computation of 2D reacting gas phase in sandwich propellant, Proc. Airbreathing engines and Aerospace propulsion, v. II, pp 462--471, Dec 1994
 51. P. A. Ramakrishna, P. J. Paul, and H. S. Mukunda., Statistical Analysis of composite propellant geometry, pp 1--5, Air breathing engines and Aerospace Propulsion, Uni. Press, 1996
 52. Nikhil. M. Patel, P. J. Paul, and H. S. Mukunda., Droplet combustion studies on dried concentrated distillery effluents, pp 389--394, Proc. 14th National Conference on Internal Combustion Engines and Combustion, Tata McGraw Hill Pub. Co., Dec. 1995

53. H. S. Mukunda., Propulsion options for low cost approach to space, Aeronautical Society of India, Trivandrum, Feb. 1997
54. H. S. Mukunda., Some non-conventional ventures in Combustion Research, pp. 56--68, Proc. XVth national conference on I.C. Engines and Combustion, Allied Publishers, 1997.
55. Amit Kumar, P. J. Paul and H. S. Mukunda., Computational study of premixed gas fired cyclone combustor, pp. 701--711, Proc. XVth National conference on Internal Combustion engines and Combustion, Allied Publishers, 1997.
56. Nagaraj Upadhyaya, Debasis Charaborty, P. J. Paul and H. S. Mukunda, Computational studies on 2-D mixing layers under hypervelocity conditions, pp. 693--700, Proc. XVth National conference on Internal Combustion engines and Combustion, Allied Publishers, 1997.

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Prof HS MUKUNDA

Prof HS Mukunda, Indian Institute of Science (IISc), Bangalore, has made significant contribution for the development of Solid, Liquid and Ramjet Propulsion Systems for Integrated Guided Missile Development Programme. He has made several innovations in the Studies relating to Design, Analysis and Testing of Liquid Propellant Rocket Engine, fine tuning of gas generator and turbo pump for Prithvi Missile.. He has chaired a number of critical reviews for Design and Development of Liquid Propellant Rocket Engine, Ramjet Engine and Solid Propellant Rocket Engines. Currently he is instrumental in guiding and reviewing the Scramjet Engine Development for Hypersonic air breathing Vehicles.

In recognition of his valuable academic contribution in the field of Missile Propulsion, the DRDO **Academic Excellence Award 2002** is conferred on Prof HS Mukunda of IISc, Bangalore .



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