Dr. Ramachandran Subramanian

Summary

Over **26 years** of academic experience in Mechanical Engineering, combined with **15 years** of industrial experience, 5 years of research experience in IIT M; Out of the box thinker with problem solving mindset

- Extensively researched and published 34 papers, in International journals, conferences and National Journals
- NPTEL certified (National Program on Technology Enhanced Learning) in "Product design and innovation"; "Product design and manufacturing" (Elite) and Inspection and "Quality control in manufacturing" (Elite)
- Guided one Research Student in the field of " Design, development and testing o CPR Unit for Home Application"
- Motivated and guided the students to work on green energy initiatives
- Designed curriculum for undergraduate and graduate courses to enable students gain in-depth knowledge
- Excellent communication skills to convey content and interact with students
- Effectively used learning management systems to track student progress
- Enabled the students to get practical knowledge in the laboratory sessions
- Performed duties as external examiner across institutions, for practical examinations
- Delivered guest lectures and seminars across institutions
- Drafted project proposals and presented papers on projects
- Designed and developed hydraulic power steering systems for loaders, Integral single deck bus, designed and developed integral double deck bus, vestibule bus, prototype buses, deep seabed mining systems, marine current turbine, robots, manipulators, underwater surveillance vehicles and Vertical Axis wind Turbines and BWRO Desalination system for Small coastal villages.as a part of industrial projects

Education

Indian Institute of Technology (IIT Madras), Chennai, India — *May 1992*
Doctor of Philosophy (Ph. D) in Mechanical Engineering

Madras University, Chennai,India — *April 1976*
Master of Science (Engineering) in Engineering Design

Madras University, Chennai,India — *April 1972*
Bachelor of Engineering in Mechanical Engineering

Ph. D Thesis

Dynamic Analysis of Closed Loop Robot Manipulators using Finite Element Method

- Designed closed loop manipulators and analyzed using Finite Element Method for the first time in the research of closed loop manipulators at the international level. This research provides information on sizing the rotary and linear joint actuators of closed and open loop robot manipulators, considering the flexibilities of links and joints.
- This method is widely recognized by researchers and included as one of the bibliographical references by Professor J.P.Merlet.
- Developed 200,000 lines FORTRAN coding in the main frame system of IIT (Madras) for the finite element analysis, using Matrix Displacement method of Serial and Parallel Robot Manipulators
- Published 20 Research Papers while submission of the Research Thesis report to IIT Madras in the year 1992.
- Some of the original research papers are included in the Bibliographical reference maintained by Prof.J.P.Merlet of INRIA,France (The reference is given below)

Dr. Ramachandran Subramanian

Bibliography (Serial Number: 74)

Ramachandran S. et al.
A finite element approach to the design and dynamic analysis of platform type manipulators.
Finite elements in Analysis and Design, 10:335-350, 1992.
Keywords: mechanical architecture,optimaldesign,statics,design.

[493] Ramachandran S. and others. A finite element approach to the designand dynamic analysis of platform type manipulators. *Finite elementsin Analysis and Design*, 10(4):335–350, 1992.

Publications

No	Title of Paper	Journal/Conference
	Research Papers 1-21 Published based on research at IIT Madras	
1.	Finite Element Approach to the Dynamics of a Machining Robot.	International Journal of Computer Applications in Technology, UK, Vol 1, No44, 20-243
2.	Reliability studies on Assembly Robots using FEM	International Journal of Advanced Robotics, Japan, Vol 7, No 4, 1993, 385-393.
3.	A Finite Element Approach to the Design and Dynamic Analysis of Platform type Robot Manipulators	International Journal of Finite Elements in Analysis and Design, USA. Vol 10, No 4, 1992, 335-350.
4.	A survey of Finite Element Method for the Dynamic Analysis of Robot Manipulators	AMSE Periodical on modeling and simulation and control B. Vol 27, No:1, Winter 1989 -1990, 23-34.
5.	A generalized approach for finding the minimum deflection path for Assembly Robots using Finite Element Method	AMSE Periodical on modeling and simulation and control B. Vol 27, No:1, Winter 1989 -1990, 35-50.
6.	Numerical and experimental determination of fundamental resonant frequencies of Platform Manipulators for varying geometry.	International Symposium of Intelligent Robotics, Bangalore, Jan 1993, 883-898
7.	An FEM approach for the study of vibration characteristics of robot manipulators constructed from fiber reinforced composite materials	International Conference on Design and Computer Integrated Manufacturing DACIM 91, PSG College of Technology, 1991.
8.	Studies on the dynamics of servo-controlled robots using FEM	Proceeding of the Eighth World Congress on Theory of Machines and Mechanisms, Czechoslovakia, August 1991.
9.	Analytical Investigations on the Dynamics of Platform Manipulators using FEM	Proceeding of the Eighth World Congress on Theory of Machines and Mechanisms, Czechoslovakia, August 1991.
10.	Flexibility effects in the reliability analysis of Robot Manipulators	International Conference on Automation, Robotics and Computer Vision, Singapore, Sep 1990, 1320-1325.
11.	An FEM approach for Robot path planning under dynamic conditions	10th International Symposium on Engineering Applications in Mechanics EAM, Queen's University, Kingston, Canada, May 1990, 67-72
12.	An approach for the design and dynamics analysis of light weight platform type manipulators using FEM	10th International Symposium on Engineering Applications in Mechanics EAM, Queen's University, Kingston, Canada, May 1990, 347-352
13.	Estimation of resonant frequencies of platform type manipulators using FEM	Fifth International Symposium on linkages and computer methods

		(Theory and practice of Mechanism) Bucharest, Romania, 1989, 513-524
14.	Determination of minimum deflection path for Assembly robots using FEM	Ibid, Bucharest, Romania, 1989, 525-530
15.	An FEM approach for estimating joint control parameters of an Industrial Robot with elastic links	International Conference on Robotics and CIM, 1989, 321-322
16.	A survey of FEM application for the dynamic analysis of robot manipulators	International Conference on Modelling and Simulation, Shenzhen, China, Nov 1988.
17.	A generalized approach for finding the minimum deflection path for assembly robots using FEM	International Conference on Modelling and Simulation, Shenzhen, China, Nov 1988.
18.	Studies on the dynamics of machining robots	National Conference on Metal cutting and metal forming, MIT, Chennai, 1990
19.	A generalized FEM procedure for the forward and inverse dynamics of robot manipulators	National Conference on CAD/CAM, PSG college of technology, 1989, CAM -2, 1-8
20.	A generalized FEM procedure for determining the input functions of a machining robot	XIII AIMTDR Conference, Calcutta, Nov 1988, Paper No: RS04, H17-21
21.	Finite element techniques in Robotics	National workshop on Robotics, Pune, April 1987, 91-95
22.	Dynamic studies on closed loop manipulators constructed from Composites- An FEM Approach	International Journal of Finite Elements in Analysis and Design, USA, Vol 16, 1994, 53-70.
23.	Conceptual design and development of a new articulating structure moving on spherical wheels for a mobile robot	University of Malaysia, KL. IASTED Conference, Austria, 1999, ADM 032
24.	Design and development of a closed loop manipulator with pantograph links for assembly tasks	Ibid
25.	Design development and experimental studies on a multi-positional Stewart type robot manipulator	International Conference in China, 2001.
26.	Finite element analysis of plastic components	Malaysia Science Congress Conference 1997.
27.	FEA of mechanical components using ANSYS	Malaysia Science Congress Conference 1997.
28.	Conceptual design and development of a structure moving on spheres for a mobile robot	Malaysia Science Congress Conference 1997
29.	Design and development of an underwater mobile robot manipulator mounted on a mobile structure moving on spheres	ICARCV 2002, Singapore.

30.	An Approach To the Development of a Green energy farm using Free flow Horizontal Axis Water turbine	International Conference on Mechanical and Manufacturing Systems (Feb 24 th - 25 th) 2016, Sri Sairam Engineering College, West Tambaram, Chennai, India.
31.	Development and Field Trials of Ultra Low Wind Speed Vertical Axis Wind Turbine.	International Conference on Mechanical and Manufacturing Systems (Feb 24 th - 25 th) 2016, Sri Sairam Engineering College, West Tambaram, Chennai, India
32.	Design And Simulation Of Parallel Robot To Assist In Cardiopulmonary Resuscitation Procedure.	National Seminar on Recent Advances in PIE and Remote Technologies for Nuclear Fuel Cycle (2010). September.
33.	Chest Compression System for Cardiopulmonary Resuscitation.	Karunya University, Vol. 6(20), Apr. 2016, PP. 2800-2809 2800 Article History: IJMEC DOI: 649123/10196 Received Date: Dec. 12, 2015 Accepted Date: Mar. 24, 2016 Available Online: Apr. 14, 20
34	Conceptual Design, Modeling And Positional Analysis Of Hybrid Robot To PerformChest Compressions During Cardiopulmonary Resuscitation.	International ScienceCongress Association 3 rd International Science Congress (ISC-2013), at KarunyaUniversity, Coimbatore, Tamil Nadu, India during 8 th – 9 th December 2013.

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Interacted actively with Prof.Bernard Roth, Prof.Rosenberg, Prof.R.D Cook, and Prof. Schwartz (University StuddGutt), Prof.P.N.Rao of Mischigan State University while in IIT Madras.

CoursesTaught

Design of Machine elements
Product Design and Development
Finite Element Method
Applied Hydraulics and Pneumatics
Computer Aided Machine Design
Mechanics of Solids
Industrial Robotics
Automobile Engineering
Analysis and Synthesis of Mechanisms
Theory of Machines
Engineering Graphics
Design of Hydraulics and Pneumatics systems
Industrial Robotics and Expert Systems
Design for Manufacture and Assembly Environments
Fluid Mechanics and Machinery Laboratory
Thermal Engineering Laboratory
Design Analysis Laboratory– To use FEA software
Metrology and Measurements Laboratory

Professional Experience

Dr. Ramachandran Subramanian

Professor of Mechanical Engineering *January 2013 – till Date*
And Dean R&D *January 2019 - till Date*
Sri Sairam Engineering College, Chennai, India
Courses taught: B.E.(Mech) & M.E (CAD/CAM)

- Product Design and Development
- Applied Hydraulics and Pneumatics
- Automobile Engineering
- Design of Hydraulics and Pneumatics systems
- Industrial Robotics and Expert Systems
- Design for Manufacture and Assembly Environments

Laboratory:

- Metrology and Measurements Laboratory

Projects:
Green Energy Initiatives:

- Designed and developed ultra-low speed wind turbine of 200 watts capacity for small communities.
- Guided B.E (Mechanical) students to Design and develop Free Flow Helical Turbine of 1 m x 1m length with hydrofoil blades to generate electrical power from flowing sea water.
- Guided B.E (Mechanical) students to design and develop a ducted 1 m diameter spherical turbine project for extraction of kinetic energy from water flowing in pipes.

Designed and developed the following:

- Free flow hydro-kinetic water turbine with 3 helical blades
- Free flow hydro-kinetic ducted water turbine with 4 helical blades
- Free flow hydro-kinetic ducted water turbine with 6 blades
- Free flow hydro-kinetic drum type water turbine
- 3 straight blade Vertical Axis Wind Turbine
- 3 helical blade Vertical Axis Wind Turbine
- 3 helical blade Vertical Axis Wind Turbine for street light application

Worked on the Conceptual Design and model of a windmill pump – blades with dimples on the surface for small Seawater RO Desalination Units

Discuss with faculty involved in Doctoral degree programs about their work and give useful suggestions for improvement.

Research Scientist *June 2008 – June 2012*
National Institute of Ocean Technology, Chennai, India

- Developed prototype of **Marine Current Turbine**
  The basic turbine design is made up of numerous hydrofoils, which rotate about an axis in an oncoming flow. The combination of the blade's instantaneous velocity and the oncoming flow, velocity produces a resultant velocity which acts at an angle of attack to the blade. This Resultant velocity produces a perpendicular lift and a parallel drag. If the angle of attack is greater than the angle subtended by the lift to drag ratio, then a positive torque and power will be produced. By using a symmetrical hydrofoil, positive torque can be produced. When coupled with an ultra-low speed permanent magnet generator, electrical power is produced and is distributed through grid tie inverters for domestic usage.
- Tested Marine Current Turbine prototype in the North Chennai Thermal Power Station out fall channel
- Extracted 160 watts of electrical power from flowing water
- Tested the turbine in shallow waters inside the sea near Ennore Port.

Head of the Department, Mechanical Engineering *June 2002 –June 2008*
Sri Muthukumaran Institute of Technology, Chennai, India

Dr. Ramachandran Subramanian

Courses taught:

- Finite Element Method
- Design of Machine elements
- Applied Hydraulics and Pneumatics
- Engineering Graphics
- Industrial Robotics

Projects

- Developed Underwater surveillance vehicle working with Bilge pumps
- Developed surveillance mobile vehicle with camera mounted on a 6 SPS platform – the platform position controlled by Pneumatics
- Developed micro Gear oil pump and lobe pump model using 3 D printing

Associate Professor, Mechanical Engineering *May 1997 – May 2002*
University of Malaysia, Kuala Lumpur, Malaysia
Designed curriculum for Mechanical Engineering comprising of the following courses:

Computer Aided Machine Design
This course explains the principles followed in the design of machine element like gears, bearing selections, and drives design. Computer codes are developed to arrive at the required dimensions. Modeling software like Pro-E and CATIA are used to make the model and do the preliminary analysis.

Computer Aided Product Design
This course explains about the development of various new products. Additionally, the new product design and procedure for selection of a single product is explained. Design examples are discussed. Assignments for the development of New design of computers and Mobile phones are given.

Computer Aided Tool Design
The design process for various types of tools like punch press etc is discussed. Computer implementation of tool design is discussed with examples and assignments are given.

Statics and Dynamics
Principles of statics and dynamics are explained and discussed with example problems. Assignments are given and evaluated for having a good understanding of the systems.

New manufacturing methods
EDM wire cut, EDM die-sinking CNC machining, Laser cutting method and automation using Robotics assembly systems are discussed in detail.

Finite element analysis theory and practice
Principles of finite element method are explained for structural, thermal and fluid interactions on structures.
Use of software ANSYS was taught with practical relevance to the existing problems.

Designed and developed the following robots and manipulators:

- Crawler robot for underwater application
- Micro-controlled autonomous mobile robot
- Underwater mobile robot moving on spheres
- Panto-graph type robot manipulator
- Pneumatic controlled Truss manipulator
- Multi-positional closed loop robot manipulator
  - First of its kind in the International level.

- The manipulator was tested using 3 D camera system and MOTUS software.

Head of Deep Seabed Mining Mission *September 1995 – May 1997*
National Institute of Ocean Technology, IIT Campus, Chennai, India

- Deep seabed mining systems
  - Performed Conceptual Design of deep seabed mining systems
  - Designed and developed systems that mine continuously to extract nodules as slurry at a pressure of 600 bar and pump it to barges for onward shipping to shore
  - Manganese nodules are available at a depth of 6000 m inside the sea
  - Ocean mining site: Located in the central Indian Ocean to mine Manganese nodule is available for mining – the site allocated by the International Seabed Authority
- Actively involved in the discussions with German and Russian delegations.
  - Detailed discussions were made to take a decision on the development of the underwater crawler for ocean mining of Manganese nodules from central Indian Ocean
  - Discussions were held separately with both German delegations and Russian delegations to understand the ocean mining operation details in complete
- Designed and developed Marine current turbine
  - Developed three blade helical turbine lab model
  - Tested the model in IIT (M) towing tank facility as proof of concept for electrical power generation with required instrumentation system
  - Tested the model in shallow water region of Bay of Bengal near Ennore port
- Conducted field trials of Marine current turbine for extracting green energy from oceans.
- Generated 160 watts of electrical power using the turbine, from the outfall sea water of North Chennai Thermal Power Station.

Assistant Professor, Mechanical Engineering *February 1992 – September 1995*
Hindustan College of Engineering, Chennai, India
Coursestaught:

- Mechanics of Solids
- Theory of Machines
- Engineering Graphics

Project guided:

- Wind tunnel testing of a lab model of a bus

Senior Product Development Engineer *March 1978 – December 1986*
Ashok Leyland Ltd, Chennai, India

i) Prototype Buses

- Designed and developed Integral bus with rear vertical engine mounted - the First prototype developed in India with vertical engine
- Proposed a new design to distribute the chassis loads uniformly so that all members of the under structure and super (body) structure are uniformly stressed.
- Optimized the structure members in the integral bus.

ii) Vestibule Bus

- Designed and developed 50’ long vestibule bus – chassis developed with ladder type frame and Double Articulated Ball (DAB) coupling for passenger application- a concept developed for the first time at the International level.
- Introduced the vestibule bus to ease the peak hour travel and make the travel comfortable for passengers.
- Enhanced the design to accommodate more passengers during peak hours.
- Involved in design and development of Double spherical ball joint couplingspecially for bus application.

- Ensured that the vehicle can take all types of loads and under any type of operating condition – torsion, climbing up the slope and going down the slope without causing any difficulty for the passengers.
- The first prototype plied between New Delhi and Agra in 1986.
- The second prototype plied between Tambaram and LIC in Chennai in 1986

iii) Integral Double deck bus

- Designed and developed Integral Double deck bus – the integral construction for the understructure developed for the first time at the International level.
- Implemented Indigenous design which replaced the earlier imported ladder type frame.
- Introduced torsion bar stabilizer in the vehicle, to have better roll over stability of the vehicle.
- Introduced and applied the concept of Finite element analysis of automobile components.

Trained by Prof.George Atland of USA Sperry Vickers in Mobile Hydraulics. (Bombay)
Trained by Commonwealth Secretariat, UK in CAD/CAM and Robotics. (Pune) – actively interacted with Prof.Dennis of Imperial College, Prof. Giles , John Curless, Rick Jarvis, Ramachandran, Sivamuthu Shanmugam of CDC who wre the corsu instructors.

Assistant Development Engineer, Research and Development *September 1977 – March 1978*
Bharat Earth Movers Ltd, Karnataka, India
Hydraulic power steering system
Heavy duty off-highway vehicles are operated in rough terrain conditions. Hydraulic power steering is very essential as the steerable axle loads are high. Hydraulic power steering eases the steering of such vehicles. Since the heavy-duty machines operate under severe conditions, emergency steering system is provided for ensuring the safety of the operator.

- Developed hydraulic power steering system for loader vehicles
- Steering valves are used for steering the vehicle
- Designed and developed fully hydraulic power steering system for Front end loaders

Associate Lecturer, Mechanical Engineering *August 1975 – September 1977*
Government College of Technology, Coimbatore, India
Courses taught:

- Theory of Machines
- Engineering Graphics

Projects:

- Involved in performance testing of diesel engines as per ISI standards

Performed two types of tests:

1. New engines are tested for duration of operations under various load conditions. After testing the component dimensions are measured and the variation in dimensions is indicated to the design team.
2. Twelve hours of load test to check the endurance of the engine.

S.Ramachandran,Dr.