Arcot Ramachandran

1945-2020

MECHANICAL ENGINEERING
INDIAN INSTITUTE OF SCIENCE

Indian Institute of Science
भारतीय विज्ञान संस्थान

A towering figure in the field of heat transfer, **Arcot Ramachandran** played a key role in shaping the Department of Mechanical Engineering (ME) at the Indian Institute of Science (IISc) in its early years. During his time at IISc, he headed not only ME, but also the Central Workshop and the Department of Industrial Management, and was also appointed the Dean of the Engineering Faculty. He has made pioneering contributions to the field of heat transfer, particularly in its application to energy generation.

Ramachandran was also an institution-builder. After he left IISc in 1967, he went on to lead IIT Madras as its Director, served as the Secretary of the Government of India's Department of Science and Technology (DST), and was appointed the Executive Director of the United Nations Centre for Human Settlements. His vision and leadership led to the formation of many new ministries, centres and policies.

For his contributions, Ramachandran has received numerous awards and honours, including the Padma Bhushan, the third highest civilian award in the country.

Published on the occasion of ME's 75th anniversary in 2020-2021, this booklet dives deep into his life and legacy, featuring accounts and anecdotes shared by his family and former students.

FOREWORD

Professor Arcot Ramachandran has been a friend, philosopher and guide to all his students and colleagues who have had the good fortune to come in contact with him. I was an ME student in his department at the Indian Institute of Science, and a colleague at IIT Madras.

He valued honest commitment and quality-focused work leading to continuous improvement of the institution. He initiated several activities at IIT Madras which were path-breaking and innovative at the time: he introduced research culture in the early 1970s and interdisciplinary R&D, breaching departmental silos; encouraged industrial consultancy and sponsored research, and gave importance to teaching, pedagogy and teachers. He was very fair in his decision-making and treatment of his colleagues, and earned their respect and trust. It was indeed a pleasure for all of us to work for and with him.

He was widely praised for his valuable contributions in the government as Secretary, Department of Science and Technology, and Director-General of CSIR.

He had a very pleasant personality and a dignity that commanded respect from both faculty members and students.

I congratulate the Department of Mechanical Engineering of the Indian Institute of Science for bringing out a publication on Prof Arcot Ramachandran during the commemoration of the 75th anniversary of the department.

R Natarajan
Former Director, IIT Madras

Early *life*

Arcot Ramachandran was born in Madras (now Chennai) in 1923.

Ramachandran's father, Sir Arcot Lakshmanaswami Mudaliar and uncle, Sir Arcot Ramaswami Mudaliar, were identical twins. Both were highly influential and famous in their own right. After moving to Chennai in 1903, they studied at Madras Christian College. While Ramaswami decided to pursue law and would later become a reputed lawyer, politician and the last Dewan of Mysore, his brother Lakshmanaswami – Ramachandran's father – went on to study medicine and specialise in obstetrics and gynaecology. Lakshmanaswami occupied several leadership positions; he was the longest-serving Vice Chancellor of Madras University and also the principal of Madras Medical College. During 1949-50, he was elected as Chairman of the Executive Board of the World Health Organisation, and chaired the 14th World Health Assembly in 1961. Both brothers also served on IISc's Court and Council, the Institute's decision-making bodies.

"If you go back a few generations, we are all from Bangalore, except my paternal grandfather [Lakshmanaswami Mudaliar] … born and brought up in Kurnool, Andhra Pradesh. He lost his mother at the age of two, and his father at 16, and was brought up by step-brothers," recollects Arcot Balakrishnan, Ramachandran's elder son and former Chair of the Department of Chemical Engineering at IIT Madras, who currently resides in Chennai.

Ramachandran himself was the second of four children; his siblings were Venugopal, Ananthakrishnan and Mahalakshmi. Venugopal was a urologist. Ananthakrishnan was a chemist who later joined and retired as the Chairman of ICI India Limited. Mahalakshmi is the only surviving sibling who lives currently in Bengaluru.

Ramachandran did his schooling at Madras Christian College High School, and then went to Loyola College. He pursued a bachelor's degree in engineering from the College of Engineering, Guindy. "Those were the war years," recalls Balakrishnan. "So, it was an accelerated programme. He completed the four-year programme in two-and-a-half years."

In 1945, Ramachandran left India on a government scholarship to pursue his master's and PhD degrees at Purdue University in the US. Travelling to the US wasn't easy in those days. He spent a month on a US troop ship to San Francisco, from where he had to take a train to Chicago and then a bus to West Lafayette, recounts Mahendra Ramachandran, his younger son, a software engineer at Intel, living in Portland, USA. "I think he wrote some of the research work for one of his first papers on that ship."

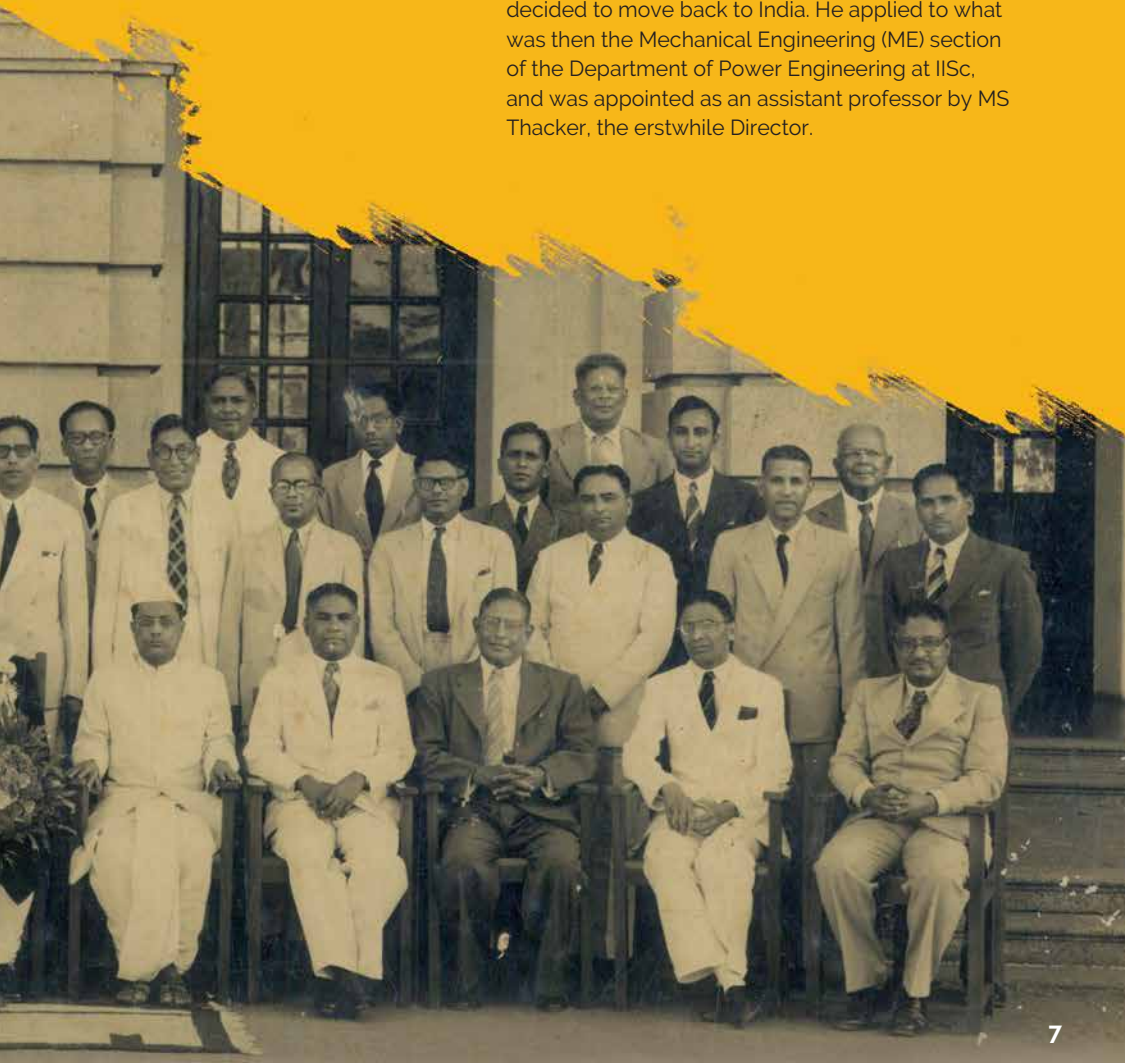
From the early days, Ramachandran was keenly interested in heat transfer. At Purdue, he worked with "giants" like Max Jakob and George Hawkins. "They had written a book on heat transfer that was something like a Bible at that time," says former student and ME faculty member MV Krishna Murthy.

While pursuing his PhD, Ramachandran stayed with an elderly American couple who hosted him as a paying guest. "He was very close to them," says Balakrishnan. Years later, when Ramachandran and his wife set up their home in Bengaluru, they named it "Chauncey" after the South Chauncey street where his hosts had lived.

Arcot Ramachandran among IISc faculty during a visit from President Rajendra Prasad in 1951

Coming to IISc

After completing his PhD, in 1950, Ramachandran decided to move back to India. He applied to what was then the Mechanical Engineering (ME) section of the Department of Power Engineering at IISc, and was appointed as an assistant professor by MS Thacker, the erstwhile Director.



Balakrishnan recalls that when Ramachandran met with Thacker, the latter also asked him to take charge of the Central Workshop at IISc, which had been set up mainly for researchers in different departments to build equipment and parts that they needed for their projects. When Ramachandran came out of Thacker's office, after that conversation, some of the senior professors suggested that he go back and refuse the responsibility as they felt it was "the toughest job in the world" and that his "career will end before it even starts." But Ramachandran did not relinquish responsibility. "He said, 'I've just met the director, I've agreed to it. I can't go back on it.' It was something that he told me many times," recalls Balakrishnan.

One of the first things that Ramachandran did was set up a heat transfer lab – the first in the country, according to a souvenir publication commemorating the ME Golden Jubilee in 1995. "At that time, very little research work was being done in India in the field of heat transfer, as there were hardly any graduate programmes in engineering," writes Krishna Murthy in *Current Science*.

When Ramachandran joined the ME section, it was headed by Clarence H Kent, a Visiting Professor from the US. In 1954, Ramachandran travelled abroad again to work for a year as a research engineer at a company called Babcock & Wilcox in Scotland. Soon after he returned, Kent left for the US, and Ramachandran subsequently took his place, says Balakrishnan. Under his tenure, the scope of research and teaching at ME expanded tremendously. He started important lines of research on heat transfer and thermodynamics, and introduced new courses of relevance to the industry.

By most accounts, Ramachandran enjoyed his time at IISc, reveling in the serene environment the campus offered to pursue his passion. His time was divided largely between the department and home, but he would sometimes stop by the Tata Memorial Club to play cards with the young staff members, according to Krishna Murthy.

Ramachandran's Research

The PE building at IISc

At IISc, Ramachandran's early research focused on problems such as measuring the temperature of hot gas streams and studying the influence of vibrating and rotating surfaces on heat transfer. A wind tunnel was built from scratch in the Central Workshop and used for investigations of heat transfer between plane surfaces and flowing air. His extensive research on diverse areas helped him gain international recognition.

"When he came back to India, he wanted to work on problems of applied heat transfer," says Krishna Murthy. "One area he did a lot of work on was the use of lignite for power plants."

Ramachandran's push for research in power generation came at the right time, says J Gururaja, another former student, who became an ME faculty member. Thermal power was "blossoming" in the country, strengthened by the establishment of Bharat Heavy Electricals Limited (BHEL), India's largest power equipment manufacturer, in 1956. "He felt that the people who graduated from IISc in thermal power would be able to work in this area in the industry."

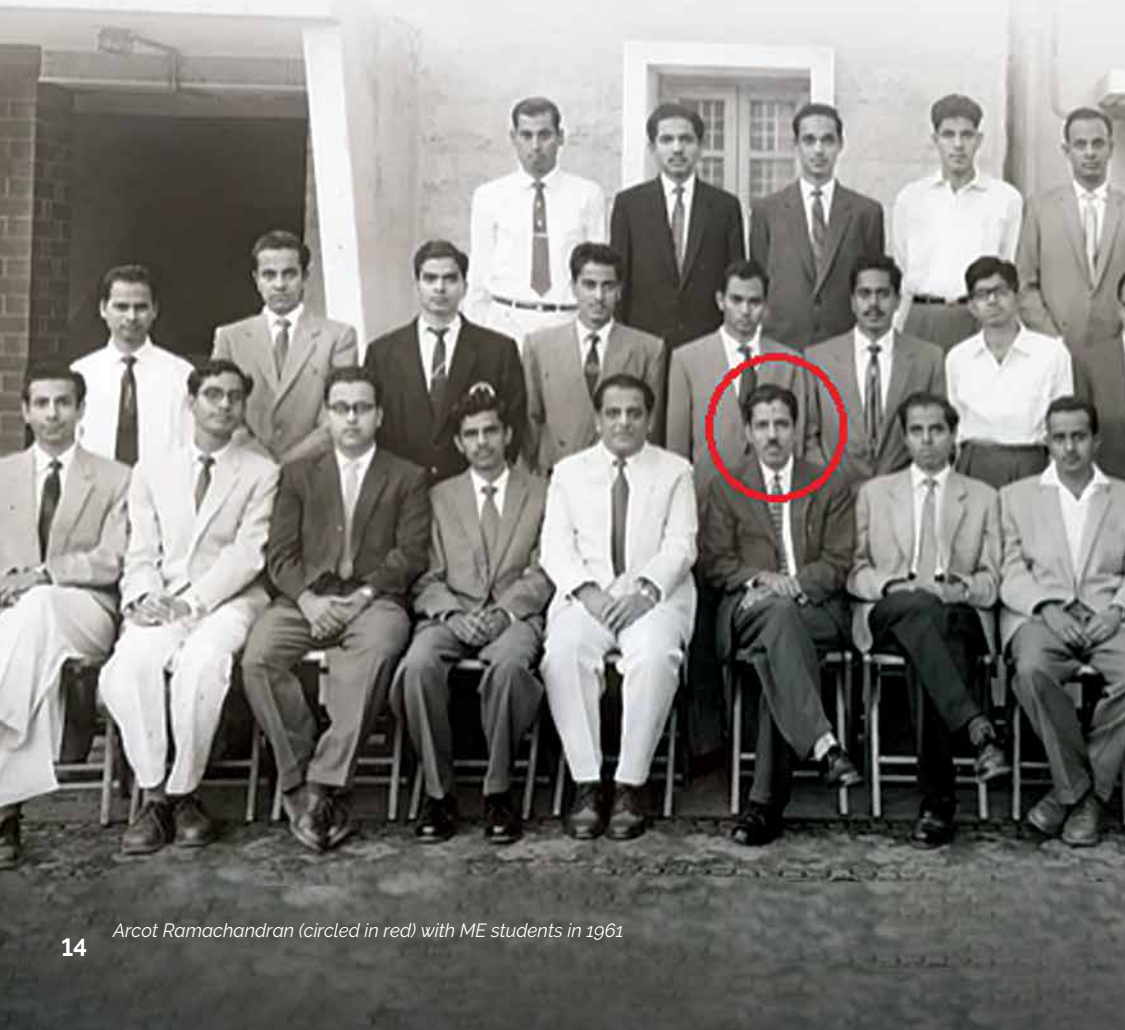
It was during Ramachandran's tenure that a full-fledged thermal power station was set up on campus to give ME students, especially those pursuing their master's degree, real-life experience in operating and maintaining a power plant. Such hands-on training helped them secure jobs at organisations like Tata Electric – the only major company in the field at that time – in Bombay, says Krishna Murthy. "The

company used to absorb all the students passing out from this ME degree programme at high salaries – Rs 800-900 per month at that time."

Ramachandran was also keenly interested in the application of heat transfer in nuclear power production. He introduced a course on nuclear engineering at ME and invited experts to give lectures on campus. He also wanted to set up a small-scale nuclear reactor on campus, but that did not materialise.

"Even as early as 1960-65, he realised the importance of heat transfer in electronic equipment and electronic cooling," explains Krishna Murthy. A major limitation in miniaturisation of integrated circuits and other components was not related to the material itself but to thermal dissipation and cooling capacity. Ramachandran convinced the Department of Electrical Communication Engineering at IISc to introduce a course on heat transfer for electronic engineering graduates. He also started several projects such as the design of kilns for cooling of electronic devices like transistors, generators and motors.

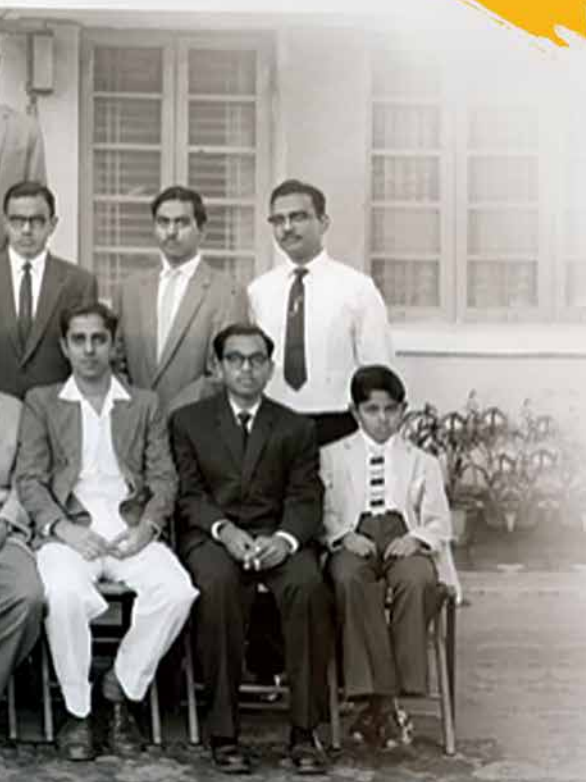
Foundry engineering was another area of interest. When S Ramamurthy, an assistant professor in foundry engineering, left IISc and joined HAL, many of the research scholars at that time were left without a guide. "He [Ramachandran] took them all in," says Balakrishnan. Ramachandran also worked closely with former faculty member MR Seshadri to study the influence of mould materials on the mechanical properties and microstructure of metals. "Together, they did a lot of work. Many publications called it the Seshadri-Ramachandran school of thought."



Arcot Ramachandran (circled in red) with ME students in 1961

Teacher *and* Mentor

Ramachandran had many distinguishing qualities that endeared him to his students.



His classes were very enjoyable, says former student and faculty member TS Mruthyunjaya. He was quite well-versed in the subjects and could teach them without referring to a book or notes. "He would move around the class, addressing each student by name and asking them questions. Nobody could doze off."

Ramachandran was also decisive, points out Gururaja. When he was admitted to IISc, Gururaja was undecided about which branch to select: aeronautics or mechanical. After hearing about Ramachandran's approachable nature, he walked into the head's office directly and told him that he was planning to join ME only if he received a scholarship. Ramachandran immediately replied that he would definitely get a scholarship, and asked him to join the very next day. "That was his style. He was very quick at making up his mind."

Every day, he would come to the lab first, instead of going straight to his office. "If there was any researcher working on something, he would sit down with them, talk to them and try to find out what and how they were doing," says Gururaja.

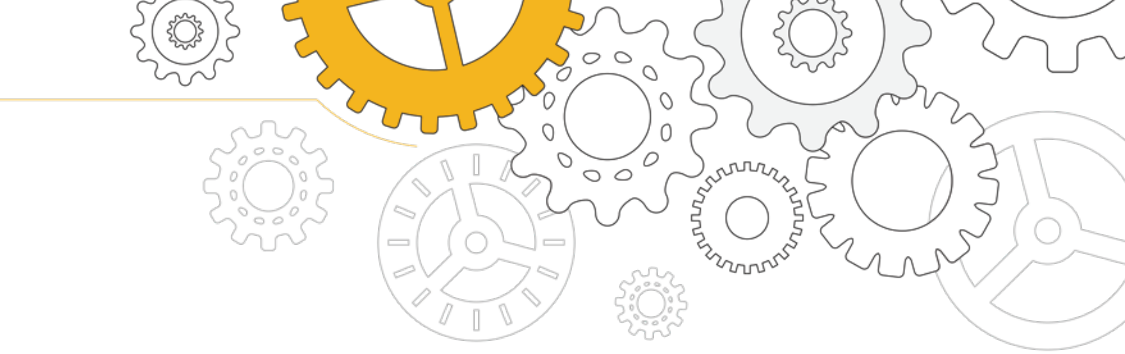
Ramachandran also took pains to remember his students' names. "When we applied to the department, we had to submit our photographs. I was told that he used to keep those photographs with him and link the face to the name. And as soon as you entered his chamber, he would shout out your name. We would be amazed," recalls Mruthyunjaya.

"He used to encourage everybody to do something original, and give them problems of practical application. His famous [phrase] was 'Go ahead,'" says Krishna Murthy. "In a lighter vein … When he was the Director at IIT Madras, Prof S Sampath, who was the Deputy Director, used to say, 'if you go to the Director and ask for anything, he would say go ahead. If I say I want to jump from the fifth floor of this building, he'd say go ahead.'"

Over the years he spent at ME, Ramachandran cultivated extensive connections that helped him procure vital equipment and facilities for the Department. In one instance, S Kasturi, another former student, needed some stainless-steel sheets to manufacture trapezoidal ducts for experiments on laminar and turbulent fluid flow. "They were not available at that time in the whole of India, except at HAL," Kasturi recalls. "Prof Ramachandran was very helpful; he contacted the Director of HAL and procured all the material."

Kasturi recounts how Ramachandran gave students complete freedom to pick their own research topics and pursue them. "He used to come and talk to us everyday, after lunch, in the lab. He was pretty helpful to all the students, and could answer any question we had right away."

Ramachandran would also ask his students pointed questions to nudge them in the right direction, according to Arkal Shenoy, another former student. "His way of teaching was not to tell you, but to ask you: Why are



you doing this? How are you going about doing this? What are the applications of the work that you are doing?"

Arkal narrates two episodes that highlight how well-respected Ramachandran was in his field. During his last semester at IISc, Ramachandran urged him and three of his classmates to apply for jobs at Tata Power, and they got called for interviews in Bombay. But Arkal was also called for an interview for a PhD programme at IIT Kanpur the same week. So, he went with the others and told Ramachandran just that he was going to the Tata Power interview. "But I didn't," he laughs. When they all came back to ME, Ramachandran came to the class and said, "Congratulations, all four of you got the job!" Feeling guilty, Arkal then confessed to Ramachandran that he had actually gone for the IIT interview. Ramachandran replied that he already knew, because the interviewers from both IIT and Tata Power had called and told him. "But they [Tata Power] anyway gave me a job, because that was the reputation and influence [he had]. He was a very sporty guy … a gem of a man."

In another instance, when Arkal travelled to the US to join a PhD programme at the Georgia Institute of Technology in 1966, he didn't have his degree certificate with him. "In those days, you would get your degree certificate in the mail after six months," he says. But to his dismay, the Registrar at Georgia Tech refused to let him join the programme without it. Stranded 9,000 miles away from home, without mobile phones or the internet, and no funds except for the promised PhD scholarship, Arkal was stumped. But when he met with the Dean of Graduate Studies and showed him a letter that he had from Ramachandran, the Dean recognised the latter right away. "From that point on, there was no discussion about my degree certificate. He said to me, 'If you are one of Ram's students, I don't need any degree certificate.'"

Arcot Ramachandran takes over charge as Director of IIT Madras from B Sengupto in the presence of CV Sethunathan, the Registrar, and S Sampath, Professor in the Department of Electrical Engineering

From IISc to IITM

Throughout his tenure at IISc, Ramachandran continued to demonstrate strong leadership capabilities. He was appointed the Dean of the Engineering Faculty in 1961. He was also asked to head the Department of Industrial Management, "even though he never studied management," points out Balakrishnan.

"He was the most respected person in the whole of the Institute. Everybody knew him," says Kasturi.

"We were thinking that he might become the Director of the Institute," says Gururaja. However, Satish Dhawan, who was a Professor in the Department of Aeronautical Engineering, was appointed instead. His appointment wasn't without controversy; some senior faculty members allegedly protested that Dhawan was too young and inexperienced, and were even contemplating filing court cases. "Dr Dhawan was an exceptionally capable person, articulate, charismatic," says Gururaja. "So whatever rumbling was there, it sort of died down very quickly."

Ramachandran, for his part, remained neutral to these rumblings. "He never thought he was a competitor," says Krishna Murthy. "In fact, he privately told me that some of the people who wanted to go to court … he advised them, 'Don't go for such a drastic step.'"

Balakrishnan adds, "They were very good friends. I used to call Prof Dhawan 'uncle.' He knew I was interested in aircraft and planes … We were very close."

Soon after Dhawan was appointed as the IISc Director, Triguna Sen, the erstwhile Union Minister for Education, asked Ramachandran to move to Chennai and become the second Director of IIT Madras (IITM). Ramachandran was

initially reluctant because he was happy with his research at IISc, and Dhawan had already asked him to take charge as the Deputy Director at IISc. "Prof Dhawan did not want him to leave IISc and go to IIT Madras," says Balakrishnan.

However, their hands were soon tied. Krishna Murthy recalls from his conversations with Ramachandran that during a meeting of the CSIR Governing Council, where both Dhawan and Ramachandran were present, along with Sen and Prime Minister Indira Gandhi, Sen apparently drew the Prime Minister's attention to the fact that Ramachandran was reluctant to move to IIT Madras and that he [Sen] wanted to "force" him to accept the offer. "Mrs Gandhi said, 'Go ahead,' or something like that. Then of course, Dr Ramachandran had no other choice." By that time, Balakrishnan had also moved to Chennai to pursue his bachelor's degree in Chemical Engineering at the University of Madras, which was an added incentive.

In 1967, Ramachandran left IISc. During his farewell meeting, Krishna Murthy says, Dhawan pointed out how Ramachandran had been heading much of the Institute – ME, the Central Workshop (which had a large employee strength) and also the Department of Industrial Management. "He said, 'What is IISc's loss is IIT's gain.'"

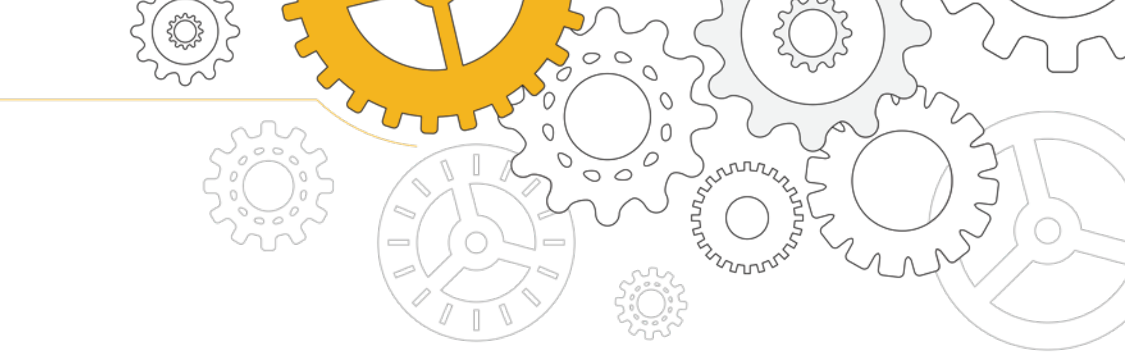
Ramachandran at the IIT Madras Convocation in 1969

At the helm of IITM

When Ramachandran moved to IITM from IISc, his younger son Mahendra was two years old. "Sometime after that, I remember that there were Holi celebrations at IITM," he recalls. "All the students came to the Director's gate and the security wouldn't allow them. So, he went to meet with them, and they put colour on him. When he came back with the Holi colours, it really freaked me out."

During the five years that Ramachandran spent at IIT Madras, he was "directly responsible for its growth as a leading research institution," writes Krishna Murthy. "In the field of heat transfer, a new school of research was established by him at IITM. This school is now a recognised centre of excellence for research in heat transfer problems related to food processing, fluidised bed combustion, and passive and active solar thermal systems." Ramachandran was instrumental in helping IITM secure an IBM 370, one of the most powerful computers in the country at that time. He also founded the Indian Society of Heat and Mass Transfer and a Regional Centre for Energy, Heat and Mass Transfer for Asia-Pacific, in order to promote professional development and partnerships between scientists in India and abroad.

"I think he was one of the most successful directors," says Balakrishnan. "He used to have his breakfast, start his car, drive around the campus, and whichever building caught his fancy, he would stop there, go in and see whatever the people were doing there. He said to me, 'That taught me a lot of things, because as long as I was in the Institute (IISc), I only knew my fluid mechanics and heat transfer. It is only when I went to IIT that I learnt about other areas.' That served him well when he went to DST."



In addition to his administrative responsibilities, he continued teaching undergraduate students in mechanical engineering. "He asked the curriculum committee to fix his hours at 9 am only so that his work wasn't disturbed. There used to be 60-65 students and he knew all of them by name," says Krishna Murthy. Every year, Ramachandran and his wife Susila also hosted the graduating senior students at their home for dinner, a tradition carried over from their time at IISc.

Krishna Murthy also narrates a memorable incident during his directorship where Ramachandran once again demonstrated his elephantine memory. When HVR Iyengar, a former Governor of the Reserve Bank of India, was appointed to the Board of Governors at IITM, the staff association organised a dinner to welcome him. "HVR Iyengar was a jovial person. He said, 'Dr Ramachandran, you are such a great engineer. Can you introduce your faculty to me?' The staff association has members from professors to technical assistants … about 750-800 at that time. Dr Ramachandran went on introducing each one … after a point HVR Iyengar said, 'I give up.' … He even remembered the names of the technical assistants."

From Chennai to Delhi

In 1971, the Government of India decided to establish a new Department of Science and Technology (DST) and tapped Ramachandran as its Secretary. He was tasked with chalking out the country's first Science and Technology plan. He was also handed the additional responsibility of Director General of the Council of Scientific and Industrial Research (CSIR).

Ramachandran with Prime Minister Morarji Desai at the International Solar Energy Congress held in New Delhi in 1978

"He had great respect for all the ministers he worked with – C Subramaniam, Indira Gandhi, Morarji Desai. He said they were excellent administrators," says Balakrishnan. "Any file he sent in the morning, it would come back by evening with a decision."

At DST, he played a key role in constituting the National Committee on Science and Technology and in bringing out the National Technology Policy Statement. He also launched national R&D initiatives related to the environment, ocean science and technology, and biotechnology. His long-term interest in energy led him to institute a national R&D programme in new energy sources. His efforts also led to the formation of the National Remote Sensing Agency, which was later absorbed into the Department of Space.

"At DST, usually my mother would drop him off in the morning, and then he'd use the government car. The driver would always come with two or three bundles of files, in those days wrapped in cloth," recalls Mahendra. "My father's routine was basically, before dinner, he would be sitting and going through the files – sometimes my mom would pass him the files. We called it his 'homework.'"

Ramachandran was particularly interested in solar energy. "Under his leadership, solar energy research, demonstration and application became the mantra of the new energy sources programme of DST," says Gururaja, who was recruited by Ramachandran to DST and became the first director of the renewable energy programme. "His personal interest in energy research and development played a catalytic role in mobilising the active participation of academic institutions, CSIR national laboratories and public sector industries to combine their efforts and harness solar energy in a major way for the benefit of the country." During his tenure, a major conference called the International Solar Energy Congress was held in Delhi in 1978, which was attended by participants from about 63 countries. "This placed India as a prominent player on the world solar energy map," Gururaja adds.

But the immense responsibility also took its toll. "When my mother was out of town, there were many times when I would wait for him to come home for dinner, and it would be 10.30-11 pm, because of some cabinet meeting or other that would go on very late," recalls Mahendra. "He used to tell me that he'll come and pick me up from school, but I told him no, because one time, I waited for two hours after school to be picked up. The Delhi years were probably the most stressful."

A higher calling *at* the UN

Ramachandran with Pope John Paul II

Ramachandran did not stay at DST for very long.

One day, as Krishna Murthy recounts, Ramachandran got a phone call from the Cabinet Secretary who informed him that he had been nominated to head the soon-to-be-established United Nations Centre for Human Settlements (UN-Habitat), headquartered in Nairobi. "He said, 'I was never consulted; I don't want to go. I want to stay in India.'" Then, he got a call from the Prime Minister Morarji Desai who urged him to accept the appointment as "the prestige of the country" was at stake. Apparently, the UN Secretary General had written to the Government of India stating that they were establishing a new Centre for Human Settlements, and wanted an experienced administrator with a good scientific background. When an IAS officer was first nominated, the Secretary General turned down the nomination and apparently told the Prime Minister, "No, we don't want any bureaucrats. When we offered this post to you, we had Dr Ramachandran in mind. If you can send Dr Ramachandran, this post is for India. Otherwise, we'll ask somebody else." Once again, Ramachandran's hand was forced and he agreed to take up the position.

At the UN, Ramachandran introduced many initiatives and programmes to promote sustainability. He proposed the idea of a World Habitat Day – observed even today on the first of October – to raise awareness about affordable and adequate shelter. Some of the key programmes he kickstarted include the Danida Training Programme in Community Participation in 1984, the Urban Management Programme in 1986, and the Sustainable Cities Programme in 1990.

In an obituary published by UN-Habitat in 2018, one of his former colleagues, Daniel Biau, remembered Ramachandran as someone who was "fair with everyone, recognising excellence and tough on mediocrity." He was also "a good diplomat, firm and respectful. He was stylish, elegant … I was often impressed by his calm authority."

Ramachandran advocated an integrated approach to human settlements, using indigenous natural resources for construction, and involving local residents in building shelters. In a recorded interview from 1991, for example, he explains that governments must not fixate on building houses for all citizens by themselves. "They must become enablers and facilitate people to help themselves. This means a change of attitude of public sector officials and local authorities to involve the people, community-based groups and NGOs in the implementation of projects."

"By that time, I was probably a junior in high school. He would actually give me his speeches to proofread," recalls Mahendra. During those Nairobi days, Ramachandran also kept himself abreast of international news, and would listen to BBC News and *Voice of America* on the shortwave radio, Mahendra adds.

Ramachandran at Home

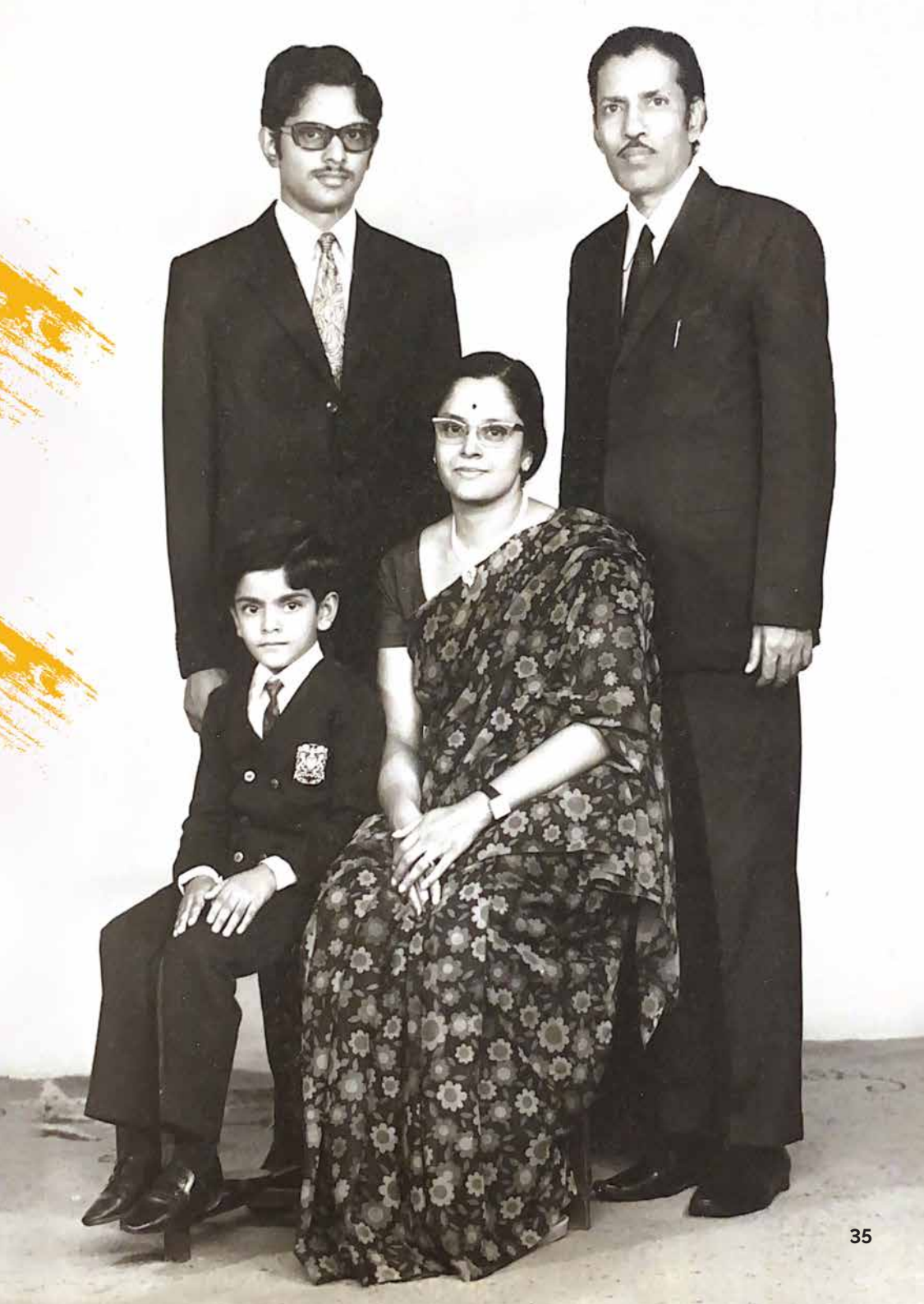
"Both my father and grandfather were very strict disciplinarians. Work came first. Once the work was done, they were very nice," says Balakrishnan. "My father always had class in the morning at 9 am on Mondays, Wednesdays and Fridays. So, on Sunday, Tuesday and Thursday evenings, we were not supposed to disturb him."

"The whole family was involved in his work life," remembers Mahendra. "My brother would go to the ME department. I would go to the Director's office in Chennai or DST in Delhi. On weekends, we'd be there, and sometimes I'd be doing my homework when he was busy going through his files."

Ramachandran was also quite sociable. "He had a lot of friends. He kept in touch with his classmates from his Purdue days almost until he passed away. When my mother died, one of his friends – who had done his PhD with him – and his wife wrote a letter of condolence," recalls Balakrishnan.

Ramachandran's wife, Susila, was from Coimbatore. "She was a Carnatic singer, and also played the veena," says Balakrishnan. "Whenever he went on a foreign trip, she would go along with him, make sure he ate his meals properly. They were a very devoted couple."

Ramachandran with his wife Susila and sons Balakrishnan and Mahendra in 1972



Mahendra also remembers how his mother would help his father keep up with his responsibilities and correspondence like emails even after retirement. "She would print them off if they were longer, or read them out to him if they were shorter – he would be sitting in his usual place on the sofa in the drawing room. He would give her the response and she would type it up and send it back."

The couple was also fond of dogs and had many of them at home over the years, wherever they went – Bengaluru, Chennai, Delhi and Nairobi, Mahendra recalls. "We actually took a dog from Delhi to Nairobi ... From Kenya, they brought a dog back too. At one time, they had four Alsatians in the house."

In Bengaluru, Susila and Ramachandran stayed close to the golf course on Palace Grounds, and Ramachandran would occasionally play there. He also enjoyed watching English movies and visiting the cinema over the weekends, Balakrishnan says.

Driving was another hobby. "He had a vintage green Vauxhall car," remembers Krishna Murthy. "He mentioned that the car was presented to him by his father-in-law. He always used to drive it at high speed."

"One of the things he and I always enjoyed was American football," says Mahendra. "In high school, we enjoyed soccer – the Bundesliga (German soccer league) and the UK premier league. We'd enjoy watching them on TV. He was very into spectator sports. But somehow my dad would always end up cheering for the team I was not cheering for. I think he would switch teams and start cheering for the other team," he jokes.

Ramachandran's cousin, A Krishnaswamy – his uncle's elder son – had been a Member of Parliament. "Our family was very aware of politics," says Balakrishnan. But Ramachandran did not let his political beliefs come in the way of his work, he adds. "He clearly worked very well with both Prime Ministers Gandhi and Desai, with both sides. He'd say that is one of the things you should be able to do, regardless of what the other person's view is. He always prided himself on being a technocrat, not a bureaucrat."

Ramachandran retired from the UN in 1993 and returned to Bengaluru. But he continued to keep busy, serving on the board of many companies and organisations and travelling to Delhi often. "He was very active until he was 90. He would never walk, he would only run. And we found it difficult to keep up with him," says Balakrishnan.

In 2003, the Government of India conferred on him the Padma Bhushan, India's third highest civilian award. In 2013, a new auditorium in ME named after him was inaugurated.

A little over a year after his wife passed away in November 2016, Ramachandran's health began to decline. By January 2018, when Mahendra visited him from the US, he could see that he'd slowed down mentally too. "Within a week of my coming back [to the US], unfortunately, he fell and hit his head … and was hospitalised for a month. From that point onwards, he was not the same man he was before." After Ramachandran returned home from the hospital, his health only deteriorated, Mahendra adds. Ramachandran eventually passed away in his home on 17 May 2018.

"He was a man who devoted his life to developing new areas and institutions of science and technology, and encouraging young people to really come out with their best talent," says Gururaja. "He was a builder of people, institutions and programmes. That is his legacy."

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