ANADI SANKAR GUPTA
(01 November 1932 – 14 June 2012)

A. S. Gupta

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(1932 – 2012)

Elected Fellow 1980

ANADI SANKAR GUPTA passed away on June 14, 2012 in Kolkata leaving behind his wife Mrs. Purabi Gupta, daughter Mrs. Debjani Banerjee, son-in-law Mr. Banibrata Banerjee and grandson Mr. Rajkumar Banerjee. Professor Gupta was living at Prembazaar, near to IIT Campus. He was born to Pramode Chandra and Usharani Gupta at Goila of the Barisal District in the then British India (now in Bangladesh) in the year 1932 (1st November). He was having eight brothers and four sisters and he himself was fourth in the series. His father was a Mining Engineer working at that time in Asansol, West Bengal, where young Anadi started his schooling at Domohani Kelejora High School. A small incident occurred at that school and it was narrated by his father (in mid '70 while he visited his loving son Anadi (Moni)) to the author who was a Ph.D. scholar working under Professor Gupta at that time. His father said, *while Moni was studying in class VII, a school inspector (British sahib) visited that unknown school where mostly students from colliery workers were studying. The Headmaster requested the inspector to recommend several things for running the school. Hearing the request, the inspector replied* "ok if anyone of your students can answer one of my questions, then only, I will recommend everything to the government. So, tell me, to whom shall I ask the question?" *All the teachers univocally said* "if you have no choice about the class, then kindly ask the question to Anadi who is the first boy in class VII. He secures full marks in all the subjects". *The inspector asked the question and Moni answered it through a quotation from Shakespeare. The inspector was an ardent lover of Shakespeare. He was very excited and instantly embraced the young bright student and said* "I never expected such an answer from a young boy like you." This was the initial journey of Anadi Sankar Gupta. However, he studied in that school during 1941–45 and later was admitted in Ushagram Boys High School in class IX. He passed Matriculation examination in 1st Division in the year 1948 securing Third position in Calcutta University out of about 60,000 students. He received gold medal for securing highest marks in Bengali (vernacular) in the Matriculation examination along with several medals for other subjects like Mathematics, Sanskrit, History, etc. He also received free studentship to pursue Higher Education in College. He studied Intermediate Science at Presidency College in Calcutta during the year 1948-1950 and passed in First Division by securing Fourth Position in the University of Calcutta with Physics, Chemistry, Mathematics, Botany, English and Bengali as his subjects. With full scholarship he completed his bachelor's degree in 1952 from Presidency College with First Class Honors in Mathematics along with subjects Physics and Chemistry and secured fourth position

in Calcutta University. During this time he won McCann Medal for proficiency in Mathematics and scholarship for further studies. He passed M.Sc. with first class 2nd in rank in Applied Mathematics from University College of Science, Calcutta University in the year 1954 and Ph.D. from Indian Institute of Technology, Kharagpur in the year 1958 based on the thesis entitled "On Compressible Flows with Heat Transfer". His Ph.D. supervisor was a renowned physicist Late Professor G. Bandyopadhyay.

While pursuing his research work for Ph.D. degree he joined in the same Department of Mathematics, IIT Kharagpur as an Assistant Lecturer in the year 1957. He married Purabi in the year 1959 and their only daughter Debjani was born in the year 1961.

He visited the Department of Applied Mathematics and Theoretical Physics, University of Cambridge, England during the year 1961-62 as a Colombo Plan Scholar. There he was associated with Sir G.K. Batchelor, L.N. Howard etc. and during this visit the remarkable contribution "Semi-circle theorem" came up. In 1966, he was awarded D.Sc. degree by IIT Kharagpur based on his seminal works presented in the thesis "Stability and Heat Transfer in Fluid Flows". In the year 1968, he was promoted to the post of Professor in the Department of Mathematics of IIT Kharagpur. He became Head of the department in the year 1976 and continued as head till 1979 before joining as a Visiting Professor in the Department of Mechanical Engineering & Applied Mechanics, University of Michigan at Ann Arbor, U.S.A. and continued there till 1981. During his stay in USA, Professor Gupta acted as a reviewer of the Reviewing Journals (I) Zentralblatt für Mathematike (Germany), and (II) Mathematical Reviews (USA). This time he was associated with Professor C.S. Yih.

Professor Gupta was the President of Annual Congress of the Indian Society of Theoretical and Applied Mechanics in 1985, Annual Congress of the National Society of Fluid Mechanics and Fluid Power in 1990 and Annual Congress of Indian Mathematical Society in 1999. He wrote a book entitled *Calculus of Variations with Applications*, published by Prentice Hall of India, New Delhi. He was in the editorial board of several international journals and continued till the last date of his life.

Even after retirement in 1993, Dr. Gupta was actively involved in research and rendered his services to IIT Kharagpur as Emeritus Professor and INSA Honorary Scientist in the Department of Mathematics. IIT Kharagpur made a rare distinction by conferring Professor Gupta as Life Fellow of IIT Kharagpur. Till the last date of his living in this eternal world, he served concurrently as Emeritus Professorship, INSA Honorary Scientist and Life Fellow of IIT Kharagpur.

His father Mr. Pramode Chandra Gupta had a great influence in shaping Professor Gupta's life in particular, value of time and determination in achieving the goal. He was always focused on his objective along with positive thinking. His

trustworthy hands were constantly extended to the needy persons. But Professor Gupta was motivated in research greatly by the research work done by his brother-in-law Dr. Mani Lal Sen Gupta who was a distinguished Chemist in Bengal Immunity Research Institute, Calcutta. Dr. Sen Gupta did pioneering works on radioactive element, but unfortunately, during that time hazards of radiation was not known to the scientific community and as a result he left this world at an early age.

Professor Gupta was awarded the Shanti Swarup Bhatnagar Prize for Mathematical Sciences in 1972 by the Government of India for his significant contributions in the field of Fluid Dynamics and Magnetohydrodynamics, notably on heat transfer in free convection flow in presence of magnetic field and FICCI (Federation of Indian Chamber of Commerce and Industry) award in 1978. In the year 1980, he was elected as a Fellow of Indian National Science Academy and later on as a Fellow of The National Academy of Sciences, India in the year 1990. He was the recipient of P.L. Bhatnagar Memorial Lecture award of Indian Mathematical Society in 1995 and Professor Vishnu Vasudeva Narlikar Memorial Lecture award of INSA in 2003. He was one of the distinguished researchers invited by world renowned Fluid Dynamist Prof. G.K. Batchelor for presenting his valuable contributions in Fluid Dynamics at the International conference in the spirit of Sir G.I. Taylor (DAMTP, Cambridge, during December 1985).

His main area of research interests were: Boundary-layer Theory, Heat and Mass Transfer in Fluid Flows, MHD, Hydrodynamic Stability and Stability of Flows. He has published 163 (so far I could able to access) research papers in all leading journals of interest. These published papers are excluding other research articles published in different conference proceedings; scientific magazines; articles in books etc. In these publications he has covered many important research topics and the numerous findings by him and his collaborators help to enrich our knowledge on understanding those topics. For example, his research on Magnetohydrodynamic free convection has important bearing on alleviating rate of heat transfer from a surface increased in an electrically conducting fluid permeated by a magnetic field. The results obtained by Professor Gupta are important in cooling of nuclear reactors with liquid metals as coolants. These theoretical results were also experimentally verified by other experimentalist. In diffusion theory, his study reveals that in the case of dispersion of a solute in viscous flow through a channel in the presence of an irreversible first-order chemical reaction, the effective Taylor diffusion coefficient decreases with increase in the reaction rate constant. This result was also verified experimentally, it was again extended by Professor Gupta to non-Newtonian fluids, giving rise to results of considerable importance in Chemical Engineering. The results of his studies on the stability characteristics of viscoelastic fluids in shear flow have important applications to polymer industry, throwing light on the phenomenon of drag reduction in the fluid flow containing traces of high polymer.

Using nonlinear stability analysis for a viscoelastic fluid flowing down an inclined plane he showed there exists of a train of solitary waves propagating on the free surface. Further it is shown that the number of solitary waves decreases with increase of the viscoelastic parameter.

He had number of collaborators not only in India but also in different countries. He could remember the name of young researchers with whom he acquainted once and also able to remember their topics of research. Prof. Gupta had the great quality of interacting freely with youngsters and other researchers for doing significant research of lasting impact in Fluid Dynamics. Even at his ripe age he would often sit and discuss with young researchers on exciting topics of great value. He never spared, even his close friends, colleagues or students to correct and put them on track whenever situation warranted.

Overall Professor Gupta was an excellent teacher. His teaching of a tough subject matter makes very simple to understand by the students. In general, most of the teachers assume that the students are having a minimum level of basic understanding knowledge on the subject. Sometimes a tough subject matter needs knowledge not only on the subject but on other subject's also, which most of the teachers neglect as a result students cannot follow properly. In case of Professor Gupta, he used to say at the beginning *"these simple things you might know"* by saying this he would start explaining the extra knowledge of other subject matter that is required to understand the tough subject that he wants to teach. He used to take 5-10 minutes in that extra subject matter and complete the lecture in allotted time. His class was like a story telling class which mixes with mathematics and physics while teaching fluid mechanics or heat transfer. He was very punctual in arriving to his teaching class and complete the topic in due time. He covers entire syllabus in specified time allotted to him. He never scolds any student for committing any silly mistake, instead used to say, *we learned the subject through committing mistakes and then correcting it only.* He always helped people around him in different ways.

At the end, I am tempted to report one incident which I myself had observed during my thesis writing in 1976. In course of my research I have found the existence of solitary waves in the form of Korteweg-de Vries equation while studying the flow of a non-Newtonian liquid over an inclined plane. However, during that time KdV equations were not well studied and also the objective of my thesis was not on solitary waves. But I wanted to write a few lines and cite a research paper in which KdV equation and the properties of the solitary waves were studied. I asked Professor Gupta if he can give me one reference. He immediately closed his eyes and started to rub his forehead and the reply was interesting. ...

By continuous rubbing the forehead he said,

- I have come across a beautiful paper long back in Soviet Physics JEPT probably it is in 1967 may be in 1970. Anyhow, you can check all these years.

- I replied, Sir, if you can be a little specific, say, at least the name of the author.

JEPT is very voluminous.

Continuous rubbing his forehead he said ....

- Author?

(As if he is trying to read the name of the author)

---- O-n-e "R" is there, o-n-e "P", also- a "K" is there.

Then suddenly he said,

"Karpman", --now you can search the journal.

I searched all the existing bound volumes of Soviet Physics JEPT from 1966 to 1970, but there was no article by any Karpman on KdV equation. With sad mood while I was about to leave the library, suddenly it struck in my mind "does all the monthly issues are in bounded volumes"? I started fresh checking and found only one issue is missing in the bounded volume of 1967. Enquiring in the library office it was found, that particular issue of the journal is issued to a faculty member of mathematics department in 1967 within a fortnight after arrival of that issue and that faculty has not returned till that date. I chase the faculty and was surprised by knowing that an issue of the journal which he has taken in 1967 from the library is still in his name. Anyhow, after a couple of days when I received that issue I found the desired article by Berezhin, Yu A & Karpman, VI *"Nonlinear evolution of disturbances in plasmas and other dispersive media"* 1967 Soviet Phys. J.E.P.T. This is the level of his memory. Once I had told him *"You have razor sharp memory."* Instantly he replied *"no, this is not razor sharp memory. But I have seen it in Sir GK Batchelor."*

Professor Gupta was a dedicated researcher who spent most of his leisure time reading books, journals or discussing research topics with students, collaborators or working. I can remember, just after accepting the responsibility of headship he had told,

- Now I have to work hard in devoting time in research. You can see many people avoid research after accepting administrative responsibility but I will devote extra time in research.

- Yes, he spent much more time in active research in that period along with administrative responsibility. In fact, he never deviated from his goal of research till the last days. In the last year of his life he has communicated/published nine research papers as evident from his list of publications.

Prof. Gupta was an inspiring model teacher, an ardent researcher and above all a rare human being of supreme noble qualities. We have missed such a great

personality but his legacy of highest qualities will linger with all the vigor on the future generation.

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