

# e-Souvenir

## **Twenty-eighth International Workshop on Matrices and Statistics**

**December 13-15, 2021**



## **International Conference on Linear Algebra and its Applications**

**December 15-17, 2021**



## **International Workshop on Algorithms for Cooperative TU Games using Matrices and Graphs**

**December 20-31, 2021**



Centre for Advanced Research  
in  
Applied Mathematics and Statistics  
MAHE, Manipal



**MANIPAL**  
ACADEMY of HIGHER EDUCATION

(Deemed to be University under Section 3 of the UGC Act, 1956)

**Centre for Advanced Research in Applied Mathematics and Statistics  
(CARAMS, MAHE), Manipal Academy of Higher Education, Manipal, India**

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# Souvenir

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**Centre for Advanced Research**  
in  
**Applied Mathematics and Statistics**  
MAHE, Manipal

**Centre for Advanced Research in  
Applied Mathematics and Statistics (CARAMS)  
Level VI, Health Sciences Library Building  
Manipal Academy of Higher Education, Manipal-576 104  
Karnataka, India**



Centre for Advanced Research  
in  
Applied Mathematics and Statistics  
MAHE, Manipal

**Twenty Eighth  
International Workshop on Matrices  
and Statistics  
IWMS 2021**

**December 13-15, 2021**

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**International Conference on  
Linear Algebra and its Applications  
ICLAA 2021**

**December 15-17, 2021**

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**International Workshop on  
Algorithm for Cooperative TU Games  
using Matrices and Graphs  
ACTGMG 2021**

**December 20-31, 2021**

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**Welcome to CARAMS, MAHE**

## From the desk of Chairman, Local Organizing Committee

**Manipal Academy of Higher Education Manipal** is synonymous with excellence in Higher Education. 30,000+ students from 65+ different nations live, learn and play in the sprawling University town, nestled on a plateau in Karnataka's Udupi district. MAHE Manipal offers 28 disciplines, 12 Program levels, 350+ programs through 31 institutions / departments. MAHE also has campuses in Mangaluru, Bengaluru & Jamshedpur and off-shore campuses in Dubai (UAE) & Melaka (Malaysia).

**Centre for Advanced Research in Applied Mathematics & Statistics (CARAMS)** has been officially established in September 2018 at MAHE with objectives of fostering advanced research and training in the area of Mathematics, Statistics and their applications. It facilitates to bridge the gap between Mathematicians/Statisticians and the Applied Mathematicians working in the area of Health, Technology, and Social Sciences.

CARAMS consists of several chapters working in different dimension of pure and applied Mathematics. Among them are (i) Algebra & Analysis (ii) Matrix Analysis & Applications (iii) Network Science and its Applications (iv) Statistics & Operations Research. Adjunct faculties of MAHE are associated with CARAMS in promoting research and act as mentors for CARAMS. Along with the activities promoting the research in Mathematics and Statistics, the centre aims at offering advanced courses in the subjects of interest. CARAMS offers positions of JRF, PDF, and visiting scientists to work in the area of CARAMS' research interests. MAHE faculty, adjunct faculty associated with MAHE and the mentors associated with CARAMS are available as advisors for the conduct of research in the area of focus.



Narayana Sabhahit  
Registrar, MAHE

CARAMS continuously organizes national and international workshop and conferences in the focus area which help the promotion of Mathematics and Statistics in the university and also in the region. CARAMS emphasis on conducting series of Lectures in Pure and Applied Mathematics, which are popular in nature, to develop several teams with members from different branches of sciences and to develop multidisciplinary projects. Please visit <https://carams.in/> for more details on the past and upcoming academic events. Recently held national workshop matrix analysis and game theory was a great success and resource materials are available in <https://carams.in/courses/>. Publications of edited volumes, special issues dedicated to conferences organized describe the quality of academic activities at CARAMS. CARAMS thank several eminent mathematicians in its network, government and private agencies who supported the activities by awarding adequate financial grant. National Board of Higher Mathematics (NBHM), Science and Engineering Research Board (SERB), Council of Scientific and Industrial Research (CSIR), India National Academy of Sciences (INSA) are among several national agencies who continuously supporting the activities of CARAMS.

The following departments

- Department of Data Science, PSPH, MAHE, Manipal
- Department of Mathematics, MIT, MAHE Manipal and
- Department of Mathematics, SMIT, SMU, Sikkim

are continuously associated with different activities being held by CARAMS.

- Indian Statistical Institute Delhi

is also in the network and associated with CARAMS in organizing a few conferences.

**About present Conferences and Workshop.** In the sequel to the conferences CMTGIM 2012, ICLAA 2014, ICLAA 2017, we have planned to organize ICLAA 2020 in December 17-19, 2020. Beside the same, we have planned for IWMS 2020(International workshop in Matrices and Statistics), 28th in its sequence, was to be held in December 15-17, 2020, in which the common day was to celebrate and honor a great applied mathematician and living legend Professor Calyampudi Radhakrishna Rao who completed 100 years of his life in the year 2020. Unfortunately, Covid-19 situation didn't allow us to organize any of these conferences in the normal format. However, we have organized ALAPS 2020 to honor Professor Rao in the online format. ICLAA and IWMS are rescheduled to 2021 and planned to organize them in the hybrid format. Further, 'International Workshop on Algorithms for Cooperative TU Games using Matrices and Graphs (ACTGMG 2021)' will be held following the conferences in December 20-31, 2021 to cater young minds of India.

Recently held national workshop matrix analysis and game theory was a great success and resource materials used in the workshop are available in the form of video lecture available in <https://carams.in/courses/>. Selected talks to be delivered in the conferences and ACTGMG will be available in the same link.

Combining online and in-person participants, more than 200 participants (as per registration details in mid November) from more than 20 nations across the globe will be attending these wonderful academic events. Among Indian participants, almost every state has representation in these conferences. These information clearly spells the quality of the conferences and workshop organized by CARAMS in December.

I welcome and also thank all the resource personnel and other delegates participating and in particular, wish a pleasant and safe stay for all the participants attending the event in-person at MAHE, Manipal during the exciting activities organized by the CARAMS.

**Dr. Narayana Sabhahit**

Registrar, MAHE

(Chairman, Local Organizing Committee)



## Overview of the events

On behalf of entire organizing team, CARAMS and MAHE, we the members of SAC welcome all the speakers and participants of triple events for IWMS 2021, ICLAA 2021 and ACTGMG 2021 organized by CARAMS, MAHE. IWMS and ICLAA were scheduled in December 2020 which could not organize in a regular format admitting physical presence of delegates due to existing Covid-19 situation. In fact, the common day between IWMS and ICLAA was planned for honoring a great living legend Professor Rao who completed 100 years of his life in the September 2020. However, ALAPS 2020 was organized to celebrate 100 years of Rao in December 2020 and the conferences IWMS 2020 and ICLAA 2020 have been rescheduled to December 13-15, 2021 and December 15-17, 2021, respectively.

**IWMS 2020.** The proposed ‘International Workshop on Matrices and Statistics’ to be held in Manipal in December 2021 is 28th in its sequence, the first was held at the University of Tampere(Tampere University) in Tampere, Finland during 6–8 August 1990. The purpose of International Workshop on Matrices and Statistics is to foster, in an informal setting, the interaction of researchers in the interface between Matrix Theory and Statistics.

The theme of the workshop shall focus on the theory and applications of the following topics in different branches of science such as Biology, Computer and Information Science, Economics, Electronics, Genetics, Office Statistics, Social Statistics and Accountancy:

- Matrix Analysis
- Projectors in Linear Models & Multivariate Analysis
- Growth Curve Models
- Linear Regression Models
- Linear Statistical Inference
- Modelling Covariance Structures
- Multivariate and Mixed Linear Models
- Statistics in Big Data Analysis.

This series of Workshops has a long history, see <https://www.sis.uta.fi/tilasto/iwms/IWMS-history.pdf> and we welcome the opportunity to hold the workshop once again in India. The 9th Workshop was held at Hyderabad in 2000, celebrating 80th birthday of Calyampudi Radhakrishna Rao, popularly known as C. R. Rao. The present 28th IWMS will be held beside ICLAA 2021, the common day between IWMS and ICLAA, December 15, 2021, will have some common sessions in honor of Prof. Calyampudi Radhakrishna Rao. We are sure that 28th IWMS will be a great success with the participation of prominent researchers from across the globe working in Statistics, Matrix Theory and allied subjects.

The purpose of the Workshop is to stimulate research and, in an informal setting, to foster the interaction of researchers in the interface between statistics and matrix theory. The Workshop will provide a forum through which statisticians may be better informed of the latest developments and newest techniques in linear algebra and matrix theory and may exchange ideas with researchers from a wide variety of countries.

As well as range of plenary speakers we are to strengthening the interactions between participants by organizing a range of minisymposia in various specialist areas. Beside organizing invited talks from eminent speakers, we invite participants to submit their research articles in the sessions of contributory talks.

**ICLAA 2021** The present ICLAA scheduled in the December 2021 is fourth in its sequence at Manipal, the was called CMTGIM and held in January 2012.

ICLAA intended to provide a platform for leading Mathematicians and Statisticians, working around the globe in the theme area to discuss several research issues and to introduce new innovations. The main goal of the conference is to bring experts, young researchers, and students together to present recent developments in this dynamic and important field. The conference also aims to stimulate research and support the interaction between the scientists by creating an environment for the participants to exchange ideas and to initiate collaborations and professional partnerships.

The theme of the conference shall focus on

- Classical Matrix Theory and Linear Algebra
- Nonnegative Matrices and Special Matrices
- Matrices and Graphs
- Combinatorial Matrix Theory
- Linear Statistical Inference
- Matrix and Graph Methods in Statistics
- Matrix and Graph Methods in Biological Sciences
- Matrices in Error Analysis and its Applications.

Linear Algebra and Graph Theory are important branches of Mathematics having applications in each and every branch of Applied Sciences. The topic ‘Matrix Methods in Statistics’ is a branch of Linear Algebra and Matrix Theory containing a variety of challenging problems in Linear Statistical Models and Statistical Inference having applications in various branches of Applied Statistics such as Natural Sciences, Medicine, Economics, Electrical Engineering, Markov Chains, Digital Signal Processing, Pattern Recognition and Neural Network, to name a few. Advances in Combinatorial Matrix theory are motivated by a wide range of subjects such as Networks, Chemistry, Genetics, Bioinformatics, Computer Science, and Information Technology. The areas of Classical Matrix Theory and Combinatorial Matrix Theory interact with each other, which is evident from the interplay between Graphs and Matrices. Generalized Inverses of Matrices such as the Incidence Matrix and Laplacian Matrix are mathematically interesting and have great practical significance. Covariance Matrices play an important role in the study of uncertainty associated with data related to measurements, which is an important part of applied Mathematics and Statistics.

This conference is in sequel to the conferences CMTGIM 2012, ICLAA 2014, and ICLAA 2017 held in Manipal during January 2012, December 2014, and December 2017 respectively. ICLAA 2021 has been endorsed by ILAS as in the case of its predecessor and we than ILAS for the same.

A special session in memory of **Prof. Arbind Lal** will be held as a part of ICLAA 2021 for which Prof. Sukanta Pati is the organizer. Prof. Arbind K Lal was an young and dynamic mathematician who was always a part of all the activities organized by CARAMS.

**ACTGMG 2021.** CARAMS, MAHE will be organizing a two-week workshop, carrying a credit of 2 points, on the topic ‘Algorithms for Cooperative TU Games using Matrices and Graphs’ during December 20-31, 2021. This is in continuation of Prof. T E S Raghavan’s effort of organizing ‘Gurukulam’ for the last few years. The course will be organized in in-person/hybrid format depending on the prevailing COVID situation. For the same reason, the dates also remain to be flexible.

The objective of the workshop is to provide an advanced input on integrating the following:

- Matrices associated with graphs such as Incidence, Adjacency and Laplacian matrices, Distance matrix of a tree and its generalizations, Resistance distance, Proof of the sensitivity conjecture, and the Algorithmic aspects of Cooperative Game Theory which

involve many basic combinatorial developments like: Max-flow min-cut, Longest paths ending in a graph, Edmond's maximum matching in a general graph.

- Completely mixed games and Perron Frobenius Theorem, Matrix games with payoff  $M$  that guarantee the solvability of the associated LCP constructively via the Lemke Howson algorithm, Totally positive matrices with their combinatorial connections and the spectral properties, Jacobi matrices and their implications to continuous time stationary Markov processes in discrete state space, and Determinantal properties of Sylvester, Gantmacher and MG Krein.

The course will be delivered through lectures on the topic in-depth and tutorials. A limited number (up to 20) of seriously interested students (Doctoral/Post-doctoral) with a good background of Linear Algebra and Calculus will be selected for participation in the workshop. They having basic knowledge of Markov Chains and Continuous Time Discrete Stochastic Process is appreciated.

It may be noted that certificates will be issued only to the participants who complete the tutorial assignments.

A few students (up to 6) will be partially sponsored by CARAMS, MAHE under Scientific Social Responsibility of different projects. Selection depends on the Supervisor/HOD's recommendation describing the possible benefits to the candidate. Candidates aspiring the support may write to the Coordinator of CARAMS (kmpasad63@gmail.com) or to T. E. S. Raghavan (terctu@gmail.com) immediately after the registration, attaching the necessary recommendation.

We wish that IWMS 2021, ICLAA 2021 and ACTGMG 2021 will attain great successes with the participation of prominent researchers from across the globe working in Matrix Theory, Graph Theory, Network Science, Statistics, and allied subjects.

**Ravindra B Bapat**

Indian Statistical Institute, Delhi  
(Chair, Scientific Advisory Committee)

**Manjunatha Prasad Karantha**

Center for Advanced Research in Applied Mathematics and Statistics  
(Convener, Scientific Advisory Committee)

**Stephen J Kirkland**

University of Manitoba, Canada  
(Member, Scientific Advisory Committee)

**Simo Puntanen**

Tampere University, Finland  
(Member, Scientific Advisory Committee)

## Warm welcome: From the desk of Chairman, IOC, IWMS

On behalf of the International Organizing Committee, IOC, of the International Workshop on Matrices and Statistics, IWMS-2021, we are very pleased to extend a warm welcome to all the participants. We are most grateful to Professor K. Manjunatha Prasad, the local organizing committee secretary, and his team on putting together such an excellent programme: in particular, taking the demanding circumstances due to Covid-19 into account. Thanks go also to the Manipal Academy of Higher Education, MAHE, and its related departments.

Now, let's look a bit backwards, 31 years only, . . . , along the lines of *A Short History of the IWMS*.

The first workshop in the International Workshop on Matrices and Statistics (IWMS) series took place at the University of Tampere in Tampere, Finland, 6–8 August 1990. It was organized by a local committee from the Statistics Unit of the Department of Mathematical Sciences at the University of Tampere.

This first IWMS was actually called *The International Workshop on Linear Models, Experimental Designs, and Related Matrix Theory*. Since 1990 the name has been changed twice, and in 1998 the IWMS became the *International Workshop on Matrices and Statistics*, following a suggestion by Professor C. Radhakrishna Rao.

In 1990 in Tampere there were 98 participants from 18 different countries. The Keynote Address was given by C. Radhakrishna Rao. The invited speakers were

Jerzy K. Baksalary	Sujit Kumar Mitra	Friedrich Pukelsheim
R. Dennis Cook	Seppo Mustonen	Jagdish N. Srivastava
Yadolah Dodge	Heinz Neudecker	George P. H. Styan
Shanti S. Gupta	Ingram Olkin	

The organizers of the group meetings were

Jerzy K. Baksalary	Sanpei Kageyama	Kirti R. Shah
Tadeusz Caliński	Jürgen Kleffe	George P. H. Styan
R. Dennis Cook	Sujit Kumar Mitra	Götz Trenkler
R. William Farebrother	Seppo Mustonen	Song-Gui Wang
Yasunori Fujikoshi	Friedrich Pukelsheim	Haruo Yanai
T.P. Hettmansperger	Jorma Rissanen	

Many of these persons have also been active participants in later workshops.

The following is an up-to-date version of the aims of the IWMS:

The purpose of the IWMS is to stimulate research and, in an informal setting, to foster the interaction of researchers in the interface between statistics and matrix theory. The Workshop will provide a forum through which statisticians may be better informed of the latest developments and newest techniques in linear algebra and matrix theory and may exchange ideas with researchers from a wide variety of countries.

Quite soon after the 2nd IWMS in Auckland, New Zealand, in December 1992, the organizing system for the IWMS found its form as two committees: International and Local. The International Organizing Committee (IOC) for several years comprised Richard William Farebrother, Simo Puntanen, George P. H. Styan, and Hans Joachim Werner. Later on, the IOC was extended (new fresh blood, of course!) and George P. H. Styan was named Honorary Chair of the IOC of the IWMS. The current IOC comprises the following members:

S. Ejaz Ahmed (Canada)  
Francisco Carvalho (Portugal)  
Katarzyna Filipiak (Poland)  
Jeffrey J. Hunter (New Zealand)  
Daniel Klein (Slovakia)  
Augustyn Markiewicz (Poland)

Simo Puntanen (Finland)  
Martin Singull (Sweden)  
George P. H. Styan (Canada)  
Júlia Volaufová (USA)  
Dietrich von Rosen (Sweden)  
Hans Joachim Werner (Germany)

Jeffrey J. Hunter has announced his intention to resign from the IOC. He has several IOC Chairs on his belt and the bottomline is: how can we survive without Jeff!

The IWMS series has had four **ILAS Lecturers**:

1. Gene H. Golub (1999), Tampere, Finland,
2. Jerzy K. Baksalary (2003), Dortmund, Germany,
3. Ravindra B. Bapat (2008), Tomar, Portugal,
4. Karl Gustafson (2015), Haikou, China;

two **Nokia Lecturers**:

1. Ingram Olkin (2004), Będlewo/Poznań, Poland,
2. C. Radhakrishna Rao (2005), Auckland, New Zealand;

and one **SAS Lecturer**:

1. Chris Gotwalt (2015), Haikou, China.

As the **IWMS Birthday Boys**, the following have been celebrated:

- T.W. Anderson (80, 90), Fort Lauderdale 1998, Tomar 2008,
- Jerzy K. Baksalary (60), Będlewo/Poznań 2004,
- Kai-Tai Fang (75), Haikou 2010,
- Lynn Roy LaMotte (70), Toronto 2013,
- Jeffrey J. Hunter (75), Funchal, 2016,
- Ingram Olkin (80, 90), Będlewo/Poznań 2004, Ljubljana 2014,
- Tarmo Pukkila (60), Uppsala 2006,
- Simo Puntanen (70), Haikou 2015,
- C. Radhakrishna Rao (80), Hyderabad 2000,
- Muni S. Srivastava (75), Tartu 2011,
- George P. H. Styan (65, 70, 75, 80), Lyngby, Windsor, Będlewo, Montréal.

As mentioned earlier, Professor **C. Radhakrishna Rao** was the Keynote Speaker in Tampere in the first IWMS in 1990. He gave a talk on “Uncertainty, statistics and creation of new knowledge”, available in YouTube-1990. Before that, Professor Rao visited Tampere in 1983, 1985 (Honorary Doctorate; George received this in 2000), and twice in 1987. His conference talk in 1987 can be watched from YouTube-1987. Professor Rao has been an active attendant of the IWMS meetings: Tampere (1990), Montréal (1995), Istanbul (1997), Fort Lauderdale

(1998), Hyderabad (2000), and Auckland (2005). Professor Rao's contributions on building up the IWMS series have been instrumental.

In this context we may shortly tell an interesting saga related to **Jerzy K. Baksalary** (1944–2005). To begin with, it's worth mentioning that Jerzy spent the period of September 1989 to September 1990 in Tampere as a Visiting Finnish Academy Professor. It was partly due to his visit that the idea of the first IWMS became real. Anyway, it so happened that after returning back to Poland, Jerzy soon started a full-time administrative career for many years as a Rector and Dean of the Tadeusz Kotarbiński Pedagogical University in Zielona Góra. But then, in the IWMS-Hyderabad in December 2000, Jerzy was back in real old good business (with his son Oskar Maria)—first put accidentally into George's room in the Secunderabad Club! That was quite a reunion, after ten years. The career of Jerzy is described by Oskar Maria Baksalary and George P. H. Styan in their article in the *LAA* (2005).

The 9th IWMS was held in Hyderabad in 9–13 December 2000, in celebration for C. R. Rao's 80th birthday. The program started with a two-day course on recent advances in matrix theory with special reference to applications to statistics. The topics of Professor Rao's talks were "Statistical proofs of some matrix inequalities" and "Antieigen and singular values of a matrix and their applications to statistics".

Simo's first visit to India was in December 1990, attending C.G. Khatri (1931–1989) Memorial Conference. Most of the period December 1992 to February 1993 Simo was in Delhi with George (on sabbatical).

While in Delhi, we prepared an interesting interview with **Sujit Kumar Mitra** (1932–2004); see PDF. Mitra, who attended the IWMS in Tampere 1990 and Montréal 1995, did his Ph.D. studies in North Carolina at Chapel Hill 1954–1956, supervisor being S.N. Roy. Below is a piece of conversation.

*And then you wrote your thesis with Professor S.N. Roy, in USA, in 1954–56. Did you feel homesick in Chapel Hill?*

"I felt terribly homesick. I don't know if it was my homesickness which was responsible for even thinking that I may come back without the degree. So I wrote to Professor P.C. Mahalanobis asking whether he would take me from the USA back to the ISI, without a degree.

But in the middle of the arrangements, I got two letters, one from D. Basu and the other from C.R. Rao. Both of them told me that I was silly and that I must first complete my PhD degree and then come to the ISI."

Below is some info about three IWMS meetings: 1990, 2000 and 2019.

**1990/1:** International Workshop on Linear Models, Experimental Designs, and Related Matrix Theory Tampere, Finland, 6–8 August 1990,  $n = 98$ .

Chair of the Organizing Committee: Erkki Liski. Program.

Videos from the conferences in statistics in Tampere in 1987 and 1990, prepared by Jarmo Niemelä and Reijo Sund.

**2000/9:** 9th International Workshop on Matrices and Statistics, Hyderabad, India, 9–13 December 2000, in celebration of *C. Radhakrishna Rao's* 80th birthday,  $n = 100$ .

Local Chairs: S.B. Rao, P. Bhimasankaram, IOC Chair: Hans Joachim Werner.

Program. Report in *Image*.

**2019/27:** 27th International Workshop on Matrices and Statistics, Shanghai University of International Business and Economics, 6–9 June 2019,  $n = 70$ .

IWMS Chair: Jeffrey J. Hunter, Local Chair: Yonghui Liu

Website. Poster. Book of Abstracts & Program. Group photo. Report in *Image*.

Invited speakers: Oskar Maria Baksalary, Rajendra Bhatia, Kai-Tai Fang, Shuangzhe Liu, Jianxin Pan, K. Manjunatha Prasad, Yongge Tian, Fuzhen Zhang, Shurong Zheng, Lixing Zhu.

- As an after-workshop to the IWMS-2019, on 12 June 2019, some participants attended the *Workshop on Advanced Multivariate Analysis*, Centre for Statistical Sciences and College of Mathematics, Sichuan University, Chengdu, China. Organizers: Jianxin Pan & Jie Zhou. Program. Group photo.

## Acknowledgements

There is an open-access website for the IWMS at the Tampere University: [www](http://www.iwms.tampere.fi), where we intend to put a good subset of associated reports and photographs of the IWMS series from 1990 onwards, including those published in *IMAGE: The Bulletin of the International Linear Algebra Society*. Complete videos, prepared by Jarmo Niemelä and Reijo Sund, of the talks at two pre-IWMS Tampere conferences in statistics in 1987 and 1990 are on YouTube. Photographs in this article are taken by Simo Puntanen.

### **Simo Puntanen**

Tampere University, Finland

(Chair of the International Organizing Committee)

### **George P.H. Styan**

McGill University, Montréal (Québec), Canada

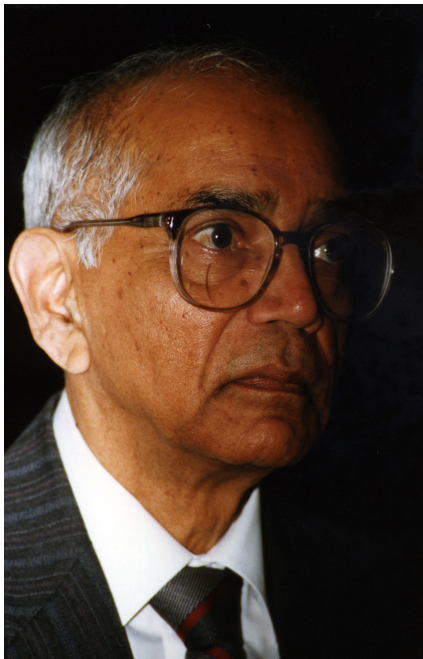
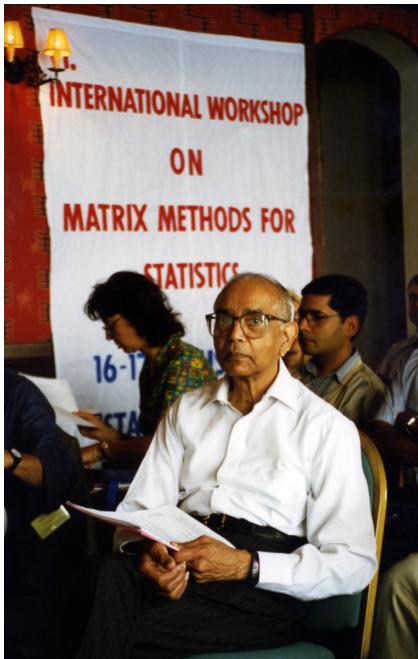
(Hon. Chair of the International Organizing Committee)



## Photographs



IWMS #4, Montréal, 15–16 July 1995: Geoffrey S. Watson, C.R. Rao (2nd row), Ingram Olkin. Program.



C.R. Rao in IWMS #6, Istanbul, 16–17 August 1997. Program.





IWMS #9, Hyderabad, India, 9–13 December 2000. To celebrate C.R. Rao's 80th birthday. Program.



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International Workshop on Linear Models, Experimental Designs & Related Matrix Theory  
6–8 August 1990, University of Tampere, Tampere, Finland

Monday, 6 August	Tuesday, 7 August	Wednesday, 8 August
<p>10:00–10:45 <b>Opening Session:</b> Tarmo PUKKILA Chair: E.P. Liski C. Radhakrishna RAO Chair: G.P.H. Styan</p> <p><b>Invited Talk:</b> 10:45–11:30 Ingram OLKIN Chair: J.K. Baksalary</p> <p>11:30–12:45 <b>Lunch</b></p> <p><b>Invited Talks:</b> 12:45–13:30 Sujit Kumar MITRA 13:30–14:15 R. Dennis COOK Chair: F. Pukelsheim</p> <p>14:15–14:45 <b>Coffee</b></p> <p><b>Group Meetings:</b> 14:45–15:45 Gustav Elfving: 1908–1984</p> <p>16:15–17:45 Mustonen Caliński Farebrother-1</p> <p>17:45–19:15 Rissanen Kageyama Farebrother-2</p> <p>20:00–... <b>Reception</b></p>	<p><b>Group Meetings:</b> 8:00–9:30 Trenkler-1 Wang Hettmansperger 9:30–11:30 Cook Baksalary</p> <p>11:30–12:45 <b>Lunch</b></p> <p><b>Group Meetings:</b> 12:45–14:15 Mitra Farebrother-3 14:15–15:45 Srivastava Yanai Farebrother-4</p> <p>15:45–16:15 <b>Coffee</b></p> <p><b>Group Meetings:</b> 16:15–17:45 Fujikoshi Pukelsheim Trenkler-2 17:45–19:15 Styan Kleffe Neudecker</p> <p>20:30–... <b>Sauna Party</b></p>	<p><b>Group Meetings:</b> 8:00–9:30 Shah Farebrother-5</p> <p>9:30–11:00 Editorial Policy in Statistical Journals</p> <p>11:00–11:30 <b>Coffee</b></p> <p>11:30–12:15 <b>Keynote Address:</b> C. Radhakrishna RAO Chair: T. Caliński</p> <p>12:15–13:30 <b>Lunch</b></p> <p><b>Invited Talks:</b> 13:30–14:00 Jagdish N. SRIVASTAVA 14:00–14:30 Shanti S. GUPTA 14:30–15:00 Yadolah DODGE Chair: T.P. Hettmansperger</p> <p>15:00–15:30 <b>Coffee</b></p> <p>15:30–16:00 Heinz NEUDECKER 16:00–16:30 Friedrich PUKELSHEIM Chair: N.R. Draper</p> <p>16:30–17:00 <b>Coffee</b></p> <p>17:00–17:30 George P. H. STYAN 17:30–18:00 Jerzy K. BAKSALARY Chair: T. Pukkila</p>

The first-mentioned groups meet in Room A I, the second in C IX (except on Monday in the Main Auditorium), and the third in A III.

Above: S.K. Mitra; George & S.K. Mitra, New Delhi, January 1993. Below: schedule of the first IWMS; Tampere, 6–8 August 1990. Program.