

Dr. Selby Jose
Professor & Head
Department of Mathematics
selbyjose@gmail.com, selbyjose@iscm.ac.in

Courses Taught

Taught the following topics at the Under Graduate (B.Sc.) and Post Graduate (M.Sc.) level according to the syllabus of University of Mumbai and Dr. Homi Bhabha State

(1) Mathematics:

- **Linear Algebra** (Books Referred: Algebra - M. Artin, Introduction to Linear Algebra - Serge Lang, Linear Algebra - K. Hoffman & R. Kunz)
- **Group Theory, Ring Theory** (Books Referred: Algebra - M. Artin, Contemporary Abstract Algebra - Joseph A. Gallian, A First Course in Abstract Algebra - J.B. Fraleigh, University Algebra - N.S. Gopalakrishnan)
- **Field Theory** (Books Referred: Abstract Algebra - D.S. Dummit & R.M. Foote, University Algebra - N.S. Gopalakrishnan, Algebra - M. Artin)
- **Coding Theory** (Books Referred: Coding Theory - San Ling & Chaoping Xing)
- **Mathematical Analysis** (Books Referred: Calculus Vol I & II - Tom M. Apostol, Methods of Real Analysis - R.R. Goldberg, Mathematical Analysis - Tom M. Apostol)
- **Metric Topology** (Books Referred: Introduction to Topology and Modern Analysis - George F. Simmons, Topology of Metric spaces - S. Kumeresan)
- **Measure Theory & Integration** (Books Referred: Real Analysis - H.L. Royden, Mathematical Analysis an Introduction - Andrew Browder)
- **Fourier Analysis** (Books Referred: Fourier Analysis an Introduction - E. M. Stein and R. Shakarchi)
- **Differential Equations** (Books Referred: Differential Equations with Applications and Historical Notes - George F. Simmons, Theory of ordinary differential Equations - E.A. Codington, N. Levinson)

(2) Computer Science:

- **Algorithms** (Book: How to solve it by Computer - R.G. Dromey)
- **C-Language** (Books: The C Programming Languages - Kernighan and Ritchie, C-programming - E. Balaguruswamy)
- **Java Basics** (Books Referred: The Complete Reference Java 2 - Patrick Niaughton & H. Schind)
- **Database Management System** (Books Referred: Database system concepts - Silberschatz, Korth, & Sudarshan)
- **System Analysis and Design** (Books Referred: Analysis and Design of Information Systems - James A. Senn)
- **Data Communications and Networking** (Books Referred: Computer Networks - Tanenbaum)

- **Data Structure and File Management** (Books Referred: An Introduction to Data Structures with Applications - J. Tremblay, P.G. Sorenson)
- **Network Security** (Books Referred: Network Security - C. Kaufman, R. Perlman, & M. Speciner)
- **Data Structure and Algorithm Using Python** (Books Referred: Karumanchi N - Data structure and algorithmic thinking with Python-CareerMonk Publications (2016))
- **Machine Learning** (Books Referred: Shai Shalev-Shwartz and Shai Ben-David, Understanding Machine Learning from Theory to Algorithms)

Research Experience

Research Area: Classical K -theory

Enrolled as a **Research Scholar** in School of Mathematics, **Tata Institute of Fundamental Research** (TIFR), Colaba, Mumbai. There I did basic Graduate Courses in Algebra, Topology and Analysis.

Did **M.Phil** (1993 - 1996) from **Pune University** under Professor S.A. Katre, with Co-guide Professor Ravi A. Rao, Tata Institute of Fundamental Research and received 'O' grade. The title of the M.Phil Thesis is **Serre's Conjecture and Complete Intersection Problem**. In the thesis we deal with the Serre's conjecture and Complete Intersection problem and given five different proofs of Serre's Conjecture.

Did **Ph. D.** (2004 - 2008) from **Pune University**. The title of the Ph. D. Thesis is **Quillen-Suslin Theory** under Professor S.A. Katre, Department of Mathematics, University of Pune with Co-guide Professor Ravi A. Rao, Tata Institute of Fundamental Research. In the Ph. D. Thesis, we deal with the study of Suslin matrices $S_r(v, w)$ and the unimodular vector group $SU_{m_r}(R)$. Analogous to the Elementary subgroup $E_r(R)$ of $GL_r(R)$, we study the Elementary Unimodular Vector subgroup $EU_{m_r}(R)$ of $SU_{m_r}(R)$. We establish Local Global Principle and Monic Inversion Principle for the pair $(EU_{m_r}(R), SU_{m_r}(R))$, $r > 1$ and proved the following:

Let R be a commutative noetherian ring with 1 and let the dimension of R be d . Then the group $SU_{m_r}(R)/EU_{m_r}(R)$ is nilpotent of class $\leq d$, for $r \geq 2$.

Visiting Fellow for post-doctoral work at School of Mathematics, Tata Institute of Fundamental Research, Colaba, Mumbai from 1st May 2008 to 31st May 2008.

Visiting Fellow for post-doctoral work at Mathematics Section of Abdus Salam International Center for Theoretical Physics (ICTP), Trieste, Italy from 8 May - 7 September 2009.

Research Project

Received a project grant of Rs.6,60,000/- (Six Lakhs and Sixty Thousand only) for the Project titled *The Study of Unimodular Rows using Suslin Matrices* under the scheme **MAThematical Research Impact Centric Support (MATRICS)** of **Science and Engineering Research Board (SERB)**, **DST**, Government of India, for a period of three years. Here we are studying about the Suslin Symbol $S_R : Um_{r+1}(R)/E_{r+1}(R) \rightarrow W_{EU}Um(R)$ defined by $S_R([v]) = [S_r(v, w)]$, which we have defined to get similar results of Vaserstein symbol for higher sized unimodular rows.

Honours, Awards and Grants

- (1) National Board of Higher Mathematics (NBHM) scholarship at M.Sc. Part II (Mathematics) of the academic year 1990 – 91.
- (2) Stood FIRST among all successful candidates at the M.Sc./M.A. (Science subjects) Examination held in April/May 1991 from Pune University.
- (3) Received different prizes at the MSc (Mathematics) Examination held in May 1991 at the University of Poona.
- (4) Received the **Teacher-Researcher Interaction Program Award 2006** from Outreach Committee, Tata Institute of Fundamental Research.

Invited Talks and Conference Presentations

- (1) Invited Webinar talk on **Solving Algebraic Equations and Field Extension** at Faculty Development Program on “Recent Trends in Mathematics” organized by Department of Mathematics & Statistics, Christian Eminent College, Indore on April 27, 2021
- (2) Invited Webinar talk on **Application of Mathematics in Google Search** at the National Webinar organized by Department of Mathematics, School of Basic Sciences and Research, Sharda University, Noida on December 30, 2020.
- (3) Invited Webinar talk on **System of Equations and its Application** at the National Webinar organized by Department of Mathematics & Statistics, Christian Eminent College, Indore on June 22, 2020
- (4) Invited talk on **Importance of Mathematics in Computer Science** at the Symposium organized by Department of Mathematics, Vidyaniketan Science and Commerce College, Ghatkopar East, Mumbai on March 7, 2020.
- (5) Invited talk on **Mathematics in Data Communication** at the Symposium organized by Department of Mathematics, R.J. College of Arts, Science and Commerce, Ghatkopar West, Mumbai on February 3, 2020.
- (6) Series of lectures delivered on **Application of Mathematical Software in Teaching and Research** at Faculty Development Program organized by KTHM College, Nasik on 27th June, 2019.
- (7) Series of lectures delivered on **Suslin Matrices and its Applications** at *Advanced Instructional School on Projective Modules* Organized by Department of Mathematics, IIT Mumbai during 21 May - 09 June, 2018.
- (8) Invited talk on **Group Theory in Data Communication** at the Workshop on Applications of Mathematics in Engineering and Real Life organized by Department of Engineering Sciences, Ramrao Adik Institute of Technology, Nerul, Navi Mumbai during February 26 - 28, 2018.
- (9) Invited Symposia talk on **On Vaserstein and Suslin Symbols** at the *International Conference on Algebra and Analysis (ICAA-2017)* organized by Department of Mathematics, Savitribai Phule Pune University, Pune during December 19 – 22, 2017.

- (10) Invited as the Guest Faculty to conduct the two day workshop on **Learning Latex** for the teachers of R.P. Gogate College of Arts & Science And R.V. Jogalekar College of Commerce, Ratnagiri, during 26 – 27 April, 2017.
- (11) Invited talk on **System of Equations and Applications** in a seminar organized by Department of Mathematics, Jai Hind College, Churchgate, Mumbai on 16th January, 2017.
- (12) Invited talk on **System of Equations and Optimization** in a seminar organized by Department of Mathematics, SIES College, Sion, Mumbai on 10th January, 2017.
- (13) Invited talk on **Role of Mathematics in Computer Science** in a two day State Level Seminar on “Role of Mathematics in Computer Science” organized by Department of Mathematics and Computer Science, K.S.K.W. Arts, Science and Commerce College, Nashik on 22nd December, 2016.
- (14) Invited talk on **Linear Algebra and its Applications** in a Seminar organized by Department of Mathematics, Thakur College of Science and Commerce, Kandivali, Mumbai on 20th December, 2016.
- (15) Invited talk on **Linear Algebra and Approximations** in ISTE approved Short Term Training Program on “Innovations and Applications of Engineering Mathematics” organized by Department of Mathematics, Vidyalankar Institute of Technology, Wadala, Mumbai on 2nd December, 2016.
- (16) Invited talk on **Cohn Transform and Symplectic orbits** at the National Conference on Commutative Algebra and Algebraic Geometry (CAAG-2015) organized by Indian Institute of Technology (IITG), Guwahati 5 – 9 February, 2015.
- (17) Invited talk on **Commutative Ring Theory and Its Applications** at the One day workshop on Topics in Ring Theory, organized by Elphinstone College, Mumbai on September 19, 2014.
- (18) Invited talk on **Career in Mathematics** at the Mathematical Colloquium, organized by Maharshi Dayanand College, Mumbai on 23 October 2013.
- (19) Invited talk on **Theory of Suslin Matrices** at the National Conference on Topics in Commutative Algebra at Institute of Science, Mumbai, during 24 – 25 January 2013.
- (20) Invited talk on **Different Perspective of a Research Problem** in a Seminar on ”Recent Research Trends In Mathematics” at the Bandodkar college, Thane, Mumbai on 8th December, 2012.
- (21) Invited Symposia talk on **Generalized Key Lemma on Suslin Matrices** at the 77th Annual Conference of the Indian Mathematical Society organized by the Swami Ramanand Teerth Marathwada University, Nanded during 27 – 30 December 2011.
- (22) Invited talk on **Generalized Key Lemma** in a One Day Symposium on Algebra at IISER, Pune on 2nd October 2010.
- (23) Invited talk on **Reflections on Unimodular rows** at the Mathematical Colloquium, Department of Mathematics, University of Bari, Bari, Italy on 4th September, 2009.

- (24) Invited Symposia talk on **Orthogonal transformations** at the 74th Annual Conference of the Indian Mathematical Society organized by the Department of Mathematics, University of Allahabad, Allahabad during 27 – 30 December 2008.
- (25) Invited for a talk on **A group structure on squares** in the "International Conference in Commutative Algebra to be held at IIT-Bombay, Mumbai from Jan 8 to 11, 2008.
- (26) Invited talk on **Unimodular rows and Orthogonal Transformations** at the Mathematical Colloquium, Tata Institute of Fundamental Research, Colaba, Mumbai on 12th October, 2006.
- (27) Invited talk on **Quillen-Suslin theory for the Special Unimodular Vector group** at the "Third National Discussion Meeting on Commutative Algebra and Algebraic Geometry" organized by Department of Mathematics, IISc, Bangalore, 16 – 21 October 2000.

List of Publications

- (1) Selby Jose and Ravi A. Rao: A local global principle for the elementary unimodular vector group, *Commutative Algebra and Algebraic Geometry (Bangalore, India, 2003)*, 119 – 125, *Contemp. Math.* 390, Amer. Math. Soc., Providence, RI, (2005).
- (2) Selby Jose and Ravi A. Rao: A Structure theorem for the Elementary Unimodular Vector group, *Trans. Amer. Math. Soc.*, 358, no.7, 3097 – 3112, (2005).
- (3) Ravi A. Rao and Selby Jose : Quillen-Suslin theory revisited, *Journal of Pure and Applied Algebra* Vol 211, Issue 2, 541 – 546 (2007).
- (4) Ravi A. Rao and Selby Jose : A group structure on squares, *Proceedings of American Mathematical Society*, vol.136, pp. 1181 – 1191 (2008).
- (5) Ravi Rao, Rabeya Basu and Selby Jose : Injective stability for K_1 of the Orthogonal group, *Journal of Algebra*, vol. 323, Issue 2, 393 – 396 (2010).
- (6) Selby Jose and Ravi A. Rao, A Fundamental property of Suslin matrices, *Journal of K-theory: K-theory and its Applications to Algebra, Geometry, and Topology* (2010), 5, 407 – 436 Cambridge University Press.
- (7) Selby Jose and Ravi A. Rao, Suslin forms and the Hodge star operator, *Linear Algebra and its Applications* 452 (2014) 328 – 344.
- (8) Selby Jose and Singh Bhatia Joginder: Linear transformation of the action of $SL_n(R)$ on the space of alternating matrices, *Int. Res. J. of Science & Engineering*, Vol. 3 (4), 143-146 (2015).
- (9) Selby Jose: Algorithmic Approach to the center of Special Unimodular Vector Group, *Int. Res. J. of Science & Engineering*, Vol. 3 (4), 147-151 (2015).
- (10) Selby Jose: The Completion of Factorial Vector of length 4, *Int. Res. J. of Science & Engineering*, Vol. 3 (4), 152-155 (2015).
- (11) Selby Jose and Singh Bhatia Joginder: On two theorems of Katre-Rao-Sheth, *Online Int. Interdisciplinary Res. J.*, Vol. 5 (5), 47-53 (2015).

- (12) Ravi A. Rao and Selby Jose: A Study of Suslin Matrices: Their Properties and Uses, Algebra and its Applications, Springer Proceedings in Mathematics & Statistics 174 (2016)
- (13) Ravi A. Rao and Selby Jose: The orbit set and the orthogonal quotient, Journal of Algebra and its applications Vol. 15, No. 6, 165 – 179 (2016).
- (14) R Khanna, S Jose, S Sharma, R A Rao: The quotient Unimodular Vector group is nilpotent (2018), Springer Proceedings in Leavitt Path Algebras and Classical K-Theory, ISSN (2523-3114), 225-240 (2020)
- (15) Bhatoa Joginder Singh, Selby Jose: Actions on Alternating matrices and Compound matrices, Springer Proceedings in Leavitt Path Algebras and Classical K-Theory, ISSN (2523-3114), 183 - 191 (2020).
- (16) Ravi A. Rao, Selby Jose: Two approaches to the Bass–Suslin conjecture, Springer Proceedings in Leavitt Path Algebras and Classical K-Theory, ISSN (2523 - 3114), 203-209 (2020).
- (17) Selby Jose, Vijay Tiwari: Study of $2 \times n$ right invertible matrix group via Suslin matrices, Journal of Xian University of Architecture & Technology, Vol 12, Issue II, 671–678 (2020).

Ph.D. Thesis Supervision

Total Eight students registered for Ph.D. under me. Two of them awarded Ph.D. Degree. One in February 2019 and the other in August 2020. The title of the first thesis was “On the non-injectivity of the Vaserstein symbol in dimension three”. The title of the second Thesis was “Quillen-Suslin Theory for the Study of Almost Suslin Matrix Groups”. Third student submitted the Thesis on May 2021.

Conference and Workshop Organized

- (1) National Conference on “Topics in Commutative Algebra” organized at The Institute of Science, Mumbai during 24-25 January, 2013.
- (2) National Workshop on “Empowering youth in the World of Mathematics” organized at The Institute of Science, Mumbai during 10-12 September, 2016.
- (3) National Workshop on “Techniques & Methods to Crack NET/SET in Mathematics” during March 31 - April 9, 2017.
- (4) National Workshop on “Techniques & Methods to Crack NET/SET in Mathematics” during 23 October - 5 November, 2017.
- (5) “National Mathematics Day – 2017, 2018, 2019, 2021” christened SIGMATICCS 2 was organized which was catalyzed and supported by “National Council for Science and Technology Communication, DST, Government of India” and “Rajiv Gandhi Science and Technology Communication, Government of Maharashtra”.

Conference/Workshop Participation

- (1) Participated 12th *National Conference on Commutative Algebra and Algebraic Geometry (CAAG-2016)* held at Indian Institute of Science Education and Research (IISER), Mohali and give an invited talk on “Generalization of Key Lemma on Suslin Matrices”, during 11 – 15 October, 2016.
- (2) Participated *International School on Computer Algebra* held at Indian Institute of Technology (IIT), Gandhinagar, during 22 – 26 February 2016
- (3) Participated *National Conference on Commutative Algebra and Algebraic Geometry (CAAG-2015)* held at Indian Institute of Technology (IITG), Guwahati and give an invited talk on “Cohn Transform and Symplectic orbits” during 5 – 9 February, 2015.
- (4) Participated *ATM Workshop on Computational Algebraic Geometry*, held at IIST, Trivandrum, Kerala, during 9 – 13 February 2014.
- (5) Participated *ATM Workshop on Classical and Non-stable Algebraic K-Theory*, 23 – 24 July 2013 organized by Tata Institute of Fundamental Research, Mumbai.
- (7) Participate in the Advanced Instructional School on *Computational Commutative Algebra and Algebraic Geometry*, held at NIIT, Neemrana, Rajasthan from January 16 – 28. 2012.
- (8) Participated the *77th Annual Conference of the Indian Mathematical Society* organized by the Swami Ramandand Teerth Marathwada University, Nanded from 27 – 30 December 2011 and give an invited talk on “Generalized Key Lemma on Suslin Matrices”.
- (9) Participated in the *International Summer School and Advanced Workshop on Trends and Developments in Linear Algebra*, 22 June – 10 July 2009 organized by International Center for Theoretical Physics (ICTP), Trieste, Italy.
- (10) Participated in the *Co-sponsored International School/Workshop on Integrable Systems and Scientific Computing*, 15 June – 20 June 2009 organized by International Center for Theoretical Physics (ICTP), Trieste, Italy.
- (11) Participated the *74th Annual Conference of the Indian Mathematical Society* organized by the Department of Mathematics, University of Allahabad, Allahabad from 27 – 30 December 2008 and give an invited talk on “Orthogonal transformations”.
- (12) Participated in the *School on Commutative Algebra and Interactions with Algebraic Geometry and Combinatorics* organized by Abdus Salam International Center for Theoretical Physics, Miramare, Trieste - Italy, from 24 May to 11 June 2004.