

Arvind Kumar

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Research Interests

My research interest is Commutative Algebra and its interaction with combinatorics. More precisely, I am very much interested in studying the algebraic properties of ideals associated with combinatorial structures in terms of combinatorial properties.

Current Position

Mar'23 – **Post-Doctoral Fellow**, Chennai Mathematical Institute, India

Professional positions held

Mar'21 – **National Post-Doctoral Fellow**, Chennai Mathematical Institute, India
Feb'23

Sept'20 – **Institute Post-Doctoral Fellow**, Indian Institute of Technology Delhi, India
Feb'21

Mar'20 – **Institute Post-Doctoral Fellow**, Indian Institute of Technology Madras, India
Aug'20

Visiting positions held

June 19-29, 2023, A ten days visit to Institute of Mathematics Hanoi, Vietnam

May 24-30, 2023, A one week visit to University of Messina, Italy to work with Prof. Giancarlo Rinaldo

May 13-20, 2023, A one week visit to University of Genova, Italy to work with Prof. Francesco Strazzanti

Feb 17-27, 2023, A ten days visit to Indian Institute of Technology Jammu, India to work with Prof. Ajay Kumar

Jan 1-8, 2022, A one week visit to Indian Institute of Technology Jammu, India to work with Prof. Rajiv Kumar

Education

2016–2020 **Ph.D., Mathematics**, Indian Institute of Technology Madras, India, GPA: 9.43/10
Thesis Title: Homological properties of binomial edge ideals
Supervisor: Prof. A. V. Jayanthan
Date of PhD defence: May 20, 2020
Date of PhD degree: July 17, 2020

2014–2016 **M.Sc., Mathematics**, Indian Institute of Technology Madras, India, GPA: 8.63/10

2011–2014 **B.Sc., Mathematics Hons.**, University of Delhi, India, Percentage: 90

Grants

- 2023 CDC Grant from European Mathematical Society for Workshop on Commutative Algebra Towards Application 2023
- 2023 Travel Grant from National Board of Higher Mathematics for ICTP School+Workshop 2023 on Commutative Algebra and Algebraic Geometry in prime characteristic p
- 2020-2022 Science and Engineering Research Board(SERB), Project title: Homological invariants of monomial ideals, Grant no.: PDF/2020/001436
- 2022 Chebyshev grant for ICM 2022

Awards and Scholarships

- 2011-2016 Inspire Scholarship
- 2016-2021 NBHM Fellowship
- 2019-2020 Institute Research Award, IIT Madras
- 2019-2020 Smt Lakshmikutty amma and Shri A Krishnankutty Nair Prize awarded for the best PhD thesis in Mathematics
- 2020-2021 Ganitam Research award by Dr. K. V. Rao Scientific Society
- 2020-2022 National Post Doctoral Fellowship
- 2022-2023 INSPIRE Faculty Fellowship 2023

Academic Achievement

- 2016 NBHM Ph.D. fellowship written and oral qualified
- 2016 CSIR–JRF Mathematics qualified
- 2014 IIT-JAM Mathematics qualified

Workshop Participation

- May'23 Commutative Algebra and Algebraic Geometry in prime characteristic, International Centre of Theoretical Physics(ICTP), Trieste, Italy
- May'23 Commutative Algebra Towards Applications, Politecnico di Torino and Università di Torino, Torino, Italy
- Jul'22 Maximal Cohen-Macaulay Modules, Chennai Mathematical Institute, India
- Mar'21 The (Virtual) International GeoGebra Conference, Institute of Mathematical Sciences, India
- Jan'21 The 17th (Virtual) Seminar on Commutative Algebra and Related Topics, Institute for Research in Fundamental Sciences(IPM), Iran
- Sep'20 One Day Workshop on Commutative Algebra and Related Fields, Constanta, Romania
- Dec'19 Advanced commutative algebra, Advanced Instructional Schools, IIT Kharagpur, India

- Jun'18 Combinatorial Commutative Algebra, ATM-Workshop, IIT Bombay, India
- Dec'17 Grobner Basis and their applications, Instructional Schools for Teachers- 2017, IIT Delhi, India
- Jun'17 Positive characteristic methods in Commutative Algebra, ATM-Workshop, IIT Bombay, India
- Dec'16 Commutative Algebra, Instructional Schools for Teachers-2016, Bhaskarcharya Pratishthana, Pune, India

Conference Presentations

- June'23 Invited talk at the conference on Commutative Algebra and its connection with Algebraic Geometry and Combinatorics 2023 held at Vietnam Academy of Science and Technology, Hanoi, Vietnam.
Title: Resurgence numbers of graded families of ideals.
- May'23 Conference on Commutative Algebra and Algebraic Geometry in prime characteristic p 2023 held at International Centre of Theoretical Physics(ICTP), Trieste, Italy.
Title: F -threshold of filtration of ideals.
- Feb'23 Conference on Commutative Algebra and Algebraic Geometry (CoCAAG-2023) held at IIT Hyderabad, India.
Title: Resurgence and asymptotic resurgence number of graded families of ideals.
- Oct'19 International Conference on Commutative Algebra and its interactions with Algebraic Geometry (CAAG-2019) held at University of Tabriz, Iran.
Title: Almost complete intersection binomial edge ideals and their Rees algebras.
- July'19 National Conference on Commutative Algebra and Algebraic Geometry (CAAG- 2019) held at IISER Bhopal, India.
Title: Regularity bound of generalized binomial edge ideal of graphs.

Teaching Experience

- Aug - Dec'22 I taught Homological Algebra course at Department of Mathematics, Chennai Mathematical Institute, India
- Aug - Dec'21 I taught Algebra III course with Professor S. S. Kannan to B.Sc. students at the Department of Mathematics, Chennai Mathematical Institute, India
- Nov - Feb'21 I was teaching assistant of Calculus(MTL100) course for B.Tech 1st year at the Department of Mathematics, Indian Institute of Technology Delhi, India.
- Jan'17 - I was teaching assistant of the following courses during my doctoral studies at
May'20 the Department of Mathematics, Indian Institute of Technology Madras, India:
 - Jan - May'20 Series and Matrices
 - Jan - May'19 Series and Matrices
 - July - Nov'18 Algebra II (M.Sc.)
 - Jan - May'18 Differential equations
 - July - Nov'17 Functions of several variables
 - Jan - May'17 Linear algebra for engineers

Seminar Talks

- Mar'23 Colloquium Talk, Chennai Mathematical Institute, Title : Linearity of resolution of powers of facet ideals of simplicial complex
- Nov'22 Research Webinar, University of Genova, Italy, Title : Combinatorial commutative algebra.
- June'21 Postdoctoral Seminar, Nanyang Technological University Singapore, Title : The subadditivity of homogeneous ideals.
- July'20 Research Seminar, IIT Bombay, Title : Regularity of binomial edge ideals.
- July'20 Research Seminar, IIT Delhi, Title : Binomial edge ideals and their regularity bounds.
- Oct'20 CATGT Webinar Series, Title : Regularity of binomial edge ideals.
- Aug'19 Algebra Seminar, IIT Madras, Title : Three lectures on Local co-homology.
- May'19 Student Seminar, IIT Madras, Title : Stanley- Reisner rings.
- Jan'19 Student Seminar, IIT Madras, Title : Hilbert's Nullstellensatz.
- Oct'18 Algebra Seminar, IIT Madras, Title : Two lectures on Regular local rings.
- Oct'18 Mathematics In house Symposium, IIT Madras, Title : Saeedi Madani-Kiani Conjecture.
- Mar'18 Algebra Seminar, IIT Madras, Title : Three lectures on Hochster's Formula.

Journal Publications

- A. V. Jayanthan and Arvind Kumar, Subadditivity, strand connectivity and multi-graded Betti numbers of monomial ideals, *J. Commut. Algebra*, Vol to appear, Year 2023 (<https://arxiv.org/abs/2007.15319>).
- Subhajit Chanda and Arvind Kumar, Properties of analogues of Frobenius powers of ideals, *Indian J. Pure Appl. Math.*, Vol to appear, Year 2022 (<https://doi.org/10.1007/s13226-022-00272-3>).
- Arvind Kumar and S. Selvaraja, Upper bounds for the regularity of symbolic powers of certain classes of edge ideals, *J. Algebra Appl.*, Vol 22, Issue 1, Paper no. 2350016, Year 2023 (<https://doi.org/10.1142/S0219498823500160>).
- Huy Tai Ha, A.V. Jayanthan, Arvind Kumar and Hop D. Nguyen, Binomial expansion for saturated and symbolic powers of sums of ideals, *J. Algebra*, Vol 620, Pages: 690-710, Year 2023 (<https://doi.org/10.1016/j.jalgebra.2022.12.037>).
- A. V. Jayanthan, Arvind Kumar and Vivek Mukundan, On the resurgence and asymptotic resurgence of homogeneous ideals, *Math. Z.*, Vol 302, Issue 4, Pages: 2407-2434, Year 2022 (<https://doi.org/10.1007/s00209-022-03138-w>).
- Arvind Kumar, Rees algebra and special fiber ring of binomial edge ideals of closed graphs, *Illinois J. Math.*, Vol 66, Issue 1, Pages: 79-90, Year 2022 (<https://doi.org/10.1215/00192082-9702270>).
- Arvind Kumar, R. Kumar, R. Sarkar and S. Selvaraja, Symbolic powers of cover ideals of certain graphs, *Acta Math. Vietnam.*, Vol 46, Issue 3, Pages: 599-611, Year 2021 (<https://doi.org/10.1007/s40306-020-00409-8>).

- Arvind Kumar, Binomial edge ideals and bounds for their regularity, *J. Algebraic Combin.*, Vol 53, Pages: 729-742, Year 2021 (<https://doi.org/10.1007/s10801-020-00939-2>).
- Arvind Kumar, Regularity of parity binomial edge ideals, *Proc. Amer. Math. Soc.*, Vol 149, Pages: 2727-2737, Year 2021 (<https://doi.org/10.1090/proc/15434>).
- Arvind Kumar, R. Kumar and R. Sarkar, Certain algebraic invariants of edge ideals of join of graphs, *J. Algebra Appl.*, Vol 20, Issue 6, Pages: 2150099, Year 2021 (<https://doi.org/10.1142/S0219498821500997>).
- Arvind Kumar, Lovász-Saks-Schrijver ideals and parity binomial edge ideals of graphs, *European J. Combin.*, Vol 93, Pages: 103274, Year 2021 (<https://doi.org/10.1016/j.ejc.2020.103274>).
- A. V. Jayanthan, Arvind Kumar and R. Sarkar, Almost complete intersection binomial edge ideals and their Rees algebras, *J. Pure Appl. Algebra*, Vol 225, Issue 6, Pages: 106628, Year 2021 (<https://doi.org/10.1016/j.jpaa.2020.106628>).
- Arvind Kumar, Binomial edge ideals of generalized block graphs, *Internat. J. Algebra Comput.*, Vol 30, Issue 8, Pages: 1537-1554, Year 2020 (<https://doi.org/10.1142/S0218196720500526>).
- Arvind Kumar and R. Sarkar, Depth and extremal Betti numbers of binomial edge ideals, *Math. Nachr.*, Vol 293, Issue 9, Pages: 1746-1761, Year 2020 (<https://doi.org/10.1002/mana.201900150>).
- A. V. Jayanthan, Arvind Kumar and R. Sarkar, Regularity of powers of quadratic sequences with applications to binomial ideals, *J. Algebra*, Vol 564, Pages: 98-118, Year 2020 (<https://doi.org/10.1016/j.jalgebra.2020.08.004>).
- Arvind Kumar, Regularity bound of generalized binomial edge ideal of graphs. *J. Algebra*, Vol 546, Pages: 357-369, Year 2020, (<https://doi.org/10.1016/j.jalgebra.2019.10.051>).
- A. V. Jayanthan and Arvind Kumar, Regularity of binomial edge ideals of Cohen-Macaulay bipartite graphs. *Comm. Algebra*, Vol 47, Issue 11, Pages: 4797-4805, Year 2019 (<https://doi.org/10.1080/00927872.2019.1596278>).
- Arvind Kumar and Rajib Sarkar, Hilbert series of binomial edge ideals. *Comm. Algebra*, Vol 47, Issue 9, Pages: 3830-3841, Year 2019 (<https://doi.org/10.1080/00927872.2019.1570241>).

— Papers Communicated

- Arvind Kumar and Rajiv Kumar, Regularity comparison of symbolic powers, integral closure of powers and powers of edge ideals, Dec 2022 (<https://arxiv.org/abs/2108.08609v2>).
- Huy Tai Ha, Arvind Kumar, Hop D. Nguyen, and Thai Thanh Nguyen, Resurgence numbers of graded families of ideals, May 2023.

— Reference

- **Prof. A.V. Jayanthan**
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Declaration

I, hereby confirm that all the above stated particulars are true to the best of my knowledge, and I can provide documentary evidence to verify all the given information.

Arvind Kumar