D Bhanu Prakash

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Profile —

I am a PhD student in Mathematics at Sri Sathya Sai Institute of Higher Learning, specializing in the fields of Dynamical Systems and Optimal Control Theory with applications in Mathematical Biology. With a strong foundation in both theoretical and applied mathematics, I have actively contributed to a three-year DAE-NBHM project, and I am currently finalizing my thesis, which I plan to submit by April. My academic journey has equipped me with robust analytical skills, innovative problem-solving abilities, and a passion for teaching and mentoring students.

Areas of Expertise

• Mathematical Modeling • Dynamical Systems • Optimal Control Theory • Data Analysis • Mathematical Ecology • Mathematical Epidemiology • Ordinary Differential Equations • Stochastic Differential Equations • Bayesian Statistics

Experience

Senior Research Fellow (SRF) - NBHM Research Project **Oct 2023 – Sep 2024**
Project funded by Department of Atomic Energy-National Board of Higher Mathematics (DAE-NBHM), GoI

- Project Title: *"Time Optimal Control Studies and Bifurcation Analysis of Coupled Nonlinear Dynamical Systems with Applications to Pest Management"*
- Esteemed stipendiary Research Fellowship, granted for one year upon successful attainment of objectives during the initial two years.
- Two Journal papers are communicated and one paper is under preparation. Delivered a talk in an international conference (RAAM-2024) organised by IIT BHU.

Junior Research Fellow (JRF) - NBHM Research Project **Oct 2021 – Sep 2023**
Project funded by Department of Atomic Energy-National Board of Higher Mathematics (DAE-NBHM), GoI

- Project Title: *"Time Optimal Control Studies and Bifurcation Analysis of Coupled Nonlinear Dynamical Systems with Applications to Pest Management"*
- Prestigious stipendiary Research Fellowship for two years, awarded on the basis of outstanding track record and research plans.
- Two Journal papers are published and one paper is communicated. Delivered a talk in an international conference (ICDECP23) organised by IIT Mandi.

Education

PhD., Mathematics **Mar 2021 – Ongoing (Est Graduation, Apr 2025)**
Sri Sathya Sai Institute of Higher Learning (SSSIHL) *Prasanthi Nilayam - 515 134, India.*

- Thesis Title: *"Deterministic and Stochastic Time Optimal Control Studies and Bifurcation Analysis of Coupled Nonlinear Dynamical Systems with Applications to Pest Management"*.
- Research Supervisor: Dr. Krishna Kiran Vamsi Dasu
- Current Status: Two journal papers are published and three papers are communicated. Delivered talks in two international and one national conferences.

M.Sc. Mathematics specialization in Computer Science **2018–2020**
Sri Sathya Sai Institute of Higher Learning (SSSIHL); GPA: 8.3/10 Prasanthi Nilayam - 515 134, India.
B.Sc. Mathematics (Hons.) specialization in Computer Science **2015–2018**
Sri Sathya Sai Institute of Higher Learning (SSSIHL); GPA: 7.5/10 Prasanthi Nilayam - 515 134, India.
Intermediate **2013–2015**
Sri Chaitanya Junior College; Score: 975/1000 *Machilipatnam - 521 001, India.*
S.S.C **2012–2013**
Sree Balajee Vidyalayam; GPA: 9.7/10 *Machilipatnam - 521 001, India.*

CERTIFICATIONS

Data Analysis with R Specialization by Duke University offered through Coursera **Mar 2025**

- Introduction to Probability and Data with R • Inferential Statistics
- Linear Regression and Modeling • Bayesian Statistics (Certificate)

Stochastic Processes by HSE University and offered through Coursera (Certificate) **Oct 2024**

PROJECTS

Risk Assessment of Cyberattacks Using Bayesian Networks **Link - Jan 2025**

- Designed and implemented a Bayesian Network model to assess the probabilistic risk of successful cyberattacks on network assets using real-world cybersecurity data.
- Analyzed pre-processed datasets to identify relationships between vulnerabilities, threat actors, attack vectors, and asset exploitation probabilities.
- Computed risk levels for various assets and developed a ranked list with actionable mitigation insights.
- Delivered data-driven strategies for prioritizing cybersecurity defenses.

Numerical Simulation of a Two-Stage Rocket **Link - Dec 2024**

- This project simulates the vertical flight of a two-stage rocket by solving a **system of ordinary differential equations (ODEs)** numerically using scipy.integrate.solve_ivp with the RK45 method. The simulation accounts for quadratic air drag and gravitational forces but does not include parachute deployment during descent.

PUBLICATIONS

Preprints

- **D. B. Prakash** and D. K. K. Vamsi, "Global dynamics and time-optimal control studies for additional food provided holling type-iii mutually interfering prey-predator systems with applications to pest management," *arXiv preprint arXiv:2406.15458*, 2024. [Online]. Available: https://doi.org/10.48550/arXiv.2406.15458
- **D. B. Prakash** and D. K. K. Vamsi, "Time-optimal control studies for additional food provided prey-predator systems involving holling type-iii and holling type-iv functional responses," *arXiv preprint arXiv:2309.13592*, 2023. [Online]. Available: https://doi.org/10.48550/arXiv.2309.13592

Journal Articles

- **D. B. Prakash** and D. Vamsi, "Stochastic time-optimal control and sensitivity studies for additional food provided prey-predator systems involving holling type-iv functional response," *Frontiers in Applied Mathematics and Statistics*, vol. 9, p. 1 122 107, 2023. [Online]. Available: https://doi.org/10.3389/fams.2023.1122107

- **D. B. Prakash** and D. K. K. Vamsi, "Stochastic optimal and time-optimal control studies for additional food provided prey–predator systems involving holling type iii functional response," *Computational and Mathematical Biophysics*, vol. 11, no. 1, p. 20 220 144, 2023. [Online]. Available: https://doi.org/10.1515/cmb-2022-0144
- B. Chhetri, D. K. K. Vamsi, **D. B. Prakash**, S. Balasubramanian, and C. B. Sanjeevi, "Age structured mathematical modeling studies on covid-19 with respect to combined vaccination and medical treatment strategies," *Computational and Mathematical Biophysics*, vol. 10, no. 1, pp. 281–303, 2022. [Online]. Available: https://doi.org/10.1515/cmb-2022-0143
- B. Chhetri, V. M. Bhagat, D. K. K. Vamsi, V. S. Ananth, **D. B. Prakash**, S. Muthusamy, P. Deshmukh, and C. B. Sanjeevi, "Optimal drug regimen and combined drug therapy and its efficacy in the treatment of covid-19: A within-host modeling study," *Acta Biotheoretica*, vol. 70, no. 2, pp. 1–28, 2022. [Online]. Available: https://doi.org/10.1007/s10441-022-09440-8
- D. S. S. M. Kanumoori, **D. B. Prakash**, D. K. K. Vamsi, and C. B. Sanjeevi, "A study of within-host dynamics of dengue infection incorporating both humoral and cellular response with a time delay for production of antibodies," *Computational and Mathematical Biophysics*, vol. 9, no. 1, pp. 66–80, 2021. [Online]. Available: https://doi.org/10.1515/cmb-2020-0118
- **D. B. Prakash**, B. Chhetri, D. K. K. Vamsi, S. Balasubramanian, and C. B. Sanjeevi, "Low temperatures or high isolation delay increases the average covid-19 infections in india: A mathematical modeling approach," *Computational and Mathematical Biophysics*, vol. 9, no. 1, pp. 146–174, 2021. [Online]. Available: https://doi.org/10.1515/cmb-2020-0122
- B. Chhetri, D. K. K. Vamsi, **D. B. Prakash**, and C. B. Sanjeevi, "Combined drug interventions and its efficacy in the reduction of covid-19 burden: A within-host modeling study with reference to hcq and bcg vaccination," *Advances in Dynamical Systems and Applications (ADSA)*, vol. 16, no. 1, pp. 369–403, 2021 Link
- B. Chhetri, V. M. Bhagat, D. K. K. Vamsi, V. S. Ananth, **D. B. Prakash**, R. Mandale, S. Muthusamy, and C. B. Sanjeevi, "Within-host mathematical modeling on crucial inflammatory mediators and drug interventions in covid-19 identifies combination therapy to be most effective and optimal," *Alexandria Engineering Journal*, vol. 60, no. 2, pp. 2491–2512, 2021. [Online]. Available: https://doi.org/10.1016/j.aej.2020.12.011
- **D. B. Prakash**, D. K. K. Vamsi, D. B. Rajesh, and C. B. Sanjeevi, "Control intervention strategies for within-host, between-host and their efficacy in the treatment, spread of covid-19: A multi scale modeling approach," *Computational and Mathematical Biophysics*, vol. 8, no. 1, pp. 198–210, 2020. [Online]. Available: https://doi.org/10.1515/cmb-2020-0111

Workshops/Conferences

Resource Persons

- Online workshop on **Mathematical Modelling of Infectious Diseases** organized by MedPro on February 20, 2025. Organized a two hour hands-on session on the topic: **Mathematical Modeling of Infectious Diseases using Python**.
- A 6-day In-person **National Winter School for Women in AI and Computational Biology - 2024** organised by the Centre for Excellence in Mathematical Biology (CEMB) of Sri Sathya Sai Institute of Higher Learning (SSSIHL) during December $2-7$, 2024. Organized a hands-on session for four hours on the topic: **Introduction to Programming and Disease Modeling using Python**. (Report)
- Faculty Development Program (FDP) on **Dynamical Systems** & **Optimal Control Theory, AI/ML, and Bioinformatics with Applications to Healthcare** organized by the Centre for Excellence in Mathematical Biology (CEMB), Sri Sathya Sai Institute of Higher Learning (SSSIHL) during July $8-15, 2024$. Organised a hands-on session for six hours on the topic: **Dynamical Systems and Optimal Control Theory with Python.**
- **Lectures on Infectious Disease Modeling** organized by ICMR-National Institute for Research in Tuberculosis (ICMR-NIRT), Department of Health, Chennai, Government of India during March

$14 - 15, 2024$. Organised a hands-on session for four hours on the topic: **Introduction to Python Programming and Exploring Basic Disease Models in Python**.

Conference Talks

- *Deterministic and Stochastic Time Optimal Control Studies of Coupled Nonlinear Dynamical Systems with Applications to Pest Management.* **2nd International Conference on Recent Advances in Applied Mathematics** (RAAM 2024) organized by Indian Institute of Technology IIT BHU, Varanasi during July 2024.
- *Deterministic and Stochastic Studies on Additional Food Provided Prey-Predator System involving Holling Type-III and Holling Type-IV Functional Responses.* **National Conference on Recent Trends in Mathematical Biology - Theory, Methods and Applications** organized by Department of Mathematics and Computer Science, Sri Sathya Sai Institute of Higher Learning (SSSIHL) during July 2023.
- *Stochastic Time-Optimal Control Studies for Additional Food Provided Prey-Predator System involving Holling Type-IV Functional Response and Mutually Interfering Predators.* **International Conference on Differential Equations and Control Problems (ICDECP23)** organized by School of Mathematics and Statistical Sciences, Indian Institute of Technology Mandi (IIT Mandi) during June 2023.

Workshop Participation

- **Certificate Program in Infectious Disease Modeling** in *online mode* by Center for Excellence in Mathematical Biology, Sri Sathya Sai Institute of Higher Learning, India during March - November 2024.
- **5-day International Faculty Development Program (FDP) on Advances in Non-linear Dynamics: Methods and Applications** (ANDMA 2024) in *online mode* by the Department of Mathematics, School of Advanced Sciences, VIT-AP University, Andhra Pradesh, India during June 11-15, 2024.
- **International Workshop on Recent advances on control theory of PDE systems** in **online mode** by the International Centre for Theoretical Sciences (ICTS), Bangalore during February 12-23,2024.
- **Winter School on Games in Evolutionary Dynamics** organized in **completely offline mode** by Department of Mathematics, Shiv Nadar Institute of Eminence (Deemed to be University), Delhi NCR during December 18-23,2023.
- **National Center for Mathematics Workshop on Control Theory for Partial Differential Equations (NCMW-CTPDE)** organized in **completely offline mode** by IISER, Thiruvananthapuram during December 04-16,2023.
- **SERB Sponsored High-End Workshop (KARYASHALA) on Bifurcations and Chaos: Computations and Applications** organized in **completely offline mode** by Department of Mathematics, Indian Institute of Technology Indore (IIT Indore) during July 03-09,2023.

Conference Participation

- *Indo-US Conference-II on the Science of Mathematical Modeling and Decision Making* held at Sri Sathya Sai Institute of Higher Learning (SSSIHL) during October 28-30, 2021.
- *National Workshop on Stochastic Differential Equations & Applications* conducted by Department of Mathematics, Periyar University, Salem during March 10-13, 2021.
- *International Workshop on Modeling Dynamics, Statistical Inference and Prediction of Infectious diseases (MoDSIP-2018)* held at Sri Sathya Sai Institute of Higher Learning (SSSIHL) during August 12-15, 2018.

MEMBERSHIP

- Life Member - Indian Academy of Mathematical Modeling and Simulation (IAMMS)
- Life Member - Forum for Industrial and Applied Mathematics (FIAM)

Honors and Awards

- APSET 2021 - **Qualified** in Mathematics
- AP EAMCET 2015 - **Rank 1939**
- TS EAMCET 2015 - **Rank 2048**
- IIT JEE Main 2015 - **Rank 17003**

Technical Skills

Programming	Python, R, MATLAB, C, C++
Softwares	LaTeX, MS Office
OS	Ubuntu, macOS, Windows

Leadership and Extracurricular Activities

- Lead the team of Audio Control group at the University and Hostel during 2016-2018.
- Lead the team of the Hostel General Stores during 2019-2023.
- Participated in Sri Sathya Sai Village Service Program - Grama Seva, providing food and clothing to over 180 villages in Andhra Pradesh, India.
- An active volunteer in Service programs of Sri Sathya Sai Seva Organisations, India.

Personal Data

- Date of Birth: 23 March, 1998
- Nationality: Indian
- Sex: Male
- Marital Status: Single
- Languages: English, Telugu, Hindi

References

- Dr. Krishna Kiran Vamsi Dasu (Ph.D. Supervisor), Associate Professor - Stage I, Department of Mathematics and Computer Science, Sri Sathya Sai Institute of Higher Learning, Prasanthi Nilayam, dkkvamsi@sssihl.edu.in
- Prof. Pallav Kumar Baruah, Senior Professor & Dean of Sciences, Department of Mathematics and Computer Science, Sri Sathya Sai Institute of Higher Learning, Prasanthi Nilayam, pkbaruah@sssihl.edu.in
- Dr. N Uday Kiran, Associate Professor, Department of Mathematics and Computer Science, Sri Sathya Sai Institute of Higher Learning, Prasanthi Nilayam, nudaykiran@sssihl.edu.in