Hariprasad K

Assistant Professor

Department of Chemical Engineering
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Personal details

Sex	Male
Date of birth	31-May-1985
Skype ID	harikodamana
Office address	MB-212, 1^{st} floor, Department of Chemical Engineering, IIT Kharagpur, West Bengal-721 302
Permanent address	Bamsuri, Puthanpally Post, Guruvayur ,Thrissur District, Kerala- 680103, India

Areas of research interest

Model Predictive control	Control relevant modelling for MPC, Set theoretic based MPC approaches, Stabilizing and robust MPC using Lyapunov methods, Computationally efficient MPC algorithms, MPC with Mixed Integer Programming
System identification	Multiple model based identification of nonlinear systems, Probabilistic approaches for robust identification, Maximum Likelihood Estimation and Expectation-Maximization (EM) algorithm for system identification
Bayesian data analytics	Bayesian methods for Probabilistic latent variable models like Probabilistic Principal Component Analysis and Probabilistic Slow Feature Analysis, Approximate Bayesian inference using Variational Bayesian methods, Application to process modelling and monitoring
Process optimization	Nonlinear, mixed integer, and multi-objective methods for optimization with application towards separation processes

Academic details

2009-2014 **Doctor of Philosophy** (Awarded R G Manudhane award for excellence in PhD thesis and Institute award for excellence in PhD thesis)

- *Thesis Title:* Modelling and stabilizing model predictive control of switched and nonlinear systems
- *Supervisor:* Prof. Sharad Bhartiya
- *Institution:* Department of Chemical Engineering, Indian Institute of Technology (IIT) Bombay, Mumbai, Maharashtra, India

2006-2008 **Master of Technology** (Process Control and Instrumentation)

- *Institution:* National Institute of Technology (NIT), Trichy, Tamilnadu, India

2002-2006 **Bachelor of Technology** (Chemical Engineering)

- *Institution:* TKM College of Engineering, Kerala University, Kerala, India

2000-2002 **Higher Secondary (Grade 12)** (HSE Board Kerala State, India)

1990-2000 **S S L C (Grade 10)** (General Education Department, Kerala, India)

Professional experience

Feb 2015– Jun 2017 **Post-doctoral fellow**, *Supervisor: Prof. Biao Huang*.
Institution: Department of Chemical and Materials Engineering, University of Alberta

Oct 2014– Feb 2015 **Research Associate**.
Institution: Indian Institute of Technology Bombay

Jun 2008– Jun 2009 **Process Engineer**.
Industry: General Electric (GE) India, John F. Welch Technology Centre, Gasification and IGCC Technology (G & IT) team

PhD thesis

2009-2014 ***Title:* Computationally efficient model predictive control (MPC) of switched and nonlinear systems**

Other projects carried out during the PhD tenure

2012– 2015 ***Project:* Optimal operational studies of a "Glucose-Fructose Simulated Moving Bed Chromatography (SMBC)" System**, Sponsor: Department of Science and Technology, India .
Supervisor: Prof. Sharad Bhartiya

Jan 2014– Jan 2015 ***Project:* Development of soft sensing methods and sensor network design for an industrial transportation system**.
Supervisors: Prof. Ravindra D Gudi and Prof. Mani Bhushan

M Tech Thesis

Jun 2007– Jun 2008 ***Title:* Adaptive control of nonlinear and multi-variable processes** .
Supervisor: Prof. T K Radhakrishnan

B Tech Thesis

Jan 2006– Jun 2006 **Modeling and Control of a non-adiabatic CSTR** .
Supervisor: Prof. S N Jyothi

Journals published/accepted

Research area key: Process optimization-$^{\alpha}$, MPC- $^{\beta}$, System identification- $^{\gamma}$, Bayesian data analytics-$^{\delta}$

1. $^{\gamma,\delta}$F. Guo, K. Hariprasad, B. Huang, Y.S. Ding, "Robust Identification of of Nonlinear Errors-in-variables Systems with parameter Uncertainties Using Variational Bayesian Approach" (Accepted to to IEEE transactions on Industrial Informatics (2017))

2. K. Hariprasad , B. Huang, "Commentary on the article 'Statistical process monitoring with independent component analysis'", Virtual Special Issue on the 25^{th} Anniversary of Journal of Process Control, 2017.
3. $^{\gamma}$F. Guo, O.Y. Wu, K. Hariprasad, Y.S. Ding, B. Huang,"An Augmented Model Approach for Identification of Nonlinear Errors-in-Variables Systems Using the EM Algorithm" (Accepted to to IEEE Transactions on Systems, Man and Cybernetics: Systems (2017))
4. $^{\gamma}$F. Guo, K. Hariprasad,B. Huang, Y.S. Ding, "Robust Identification for Nonlinear Errors-in-variables Systems Using the EM Algorithm" (Accepted to Journal of Process Control (2017))
5. $^{\beta}$K. Hariprasad and S. Bhartiya, "An efficient and stabilizing Model Predictive Control of switched systems", IEEE Transactions of Automatic Control, 2016 (Article in press)
6. $^{\alpha}$S.V. Vignesh, K. Hariprasad, P. Athawale, S.Vinod, S. Bhartiya "Optimal strategies for transitions in Simulated Moving Bed Chromatography", Computers & Chemical Engineering ,84, 83-95, 2016.
7. $^{\beta}$K. Hariprasad and S. Bhartiya, "A computationally efficient robust tube based MPC for switched systems", Nonlinear Analysis: Hybrid Systems Journal, 19, 60-76, 2016.
8. $^{\beta}$K. Hariprasad, S. Bhartiya, and R. Gudi, "A gap metric based multiple model approach for nonlinear switched systems", Journal of Process Control, vol. 22, no. 9, pp. 1743 1754, 2012 (19 citations).
9. $^{\beta}$G. Balasubramanian, K. Hariprasad, N. Sivakumaran,T.K. Radhakrishnan,"Adaptive control of multivariable process using recurrent neural networks", Instrumentation Science and Technology, 37 (6), 615-630, 2009 (3 citations).
10. $^{\beta}$G. Balasubramanian, K. Hariprasad, N. Sivakumaran,T.K. Radhakrishnan, "Adaptive control of neutralization process using recurrent neural networks" Instrumentation Science and Technology, 37 (4), 383-396, 2009(3 citations).

Journals under revision

1. $^{\gamma}$ K. Hariprasad, B. Huang, R. Ranjan, Y. Zhao, R. Tan, "Robust identification: probabilistic approaches"(Submitted to Journal of Process Control (2016) for review)
2. $^{\delta}$ Z. Liu, K. Hariprasad, A. Artin, B. Huang, "Markov Random Field based image segmentation for PSV interface detection" (Submitted to IEEE Transactions on Instrumentation and Measurement for review (2017))

Peer reviewed international proceedings (Full paper based)

1. $^{\gamma}$ O. Wu, K. Hariprasad, N. M. Jan, R. Tan, B. Huang, "Robust soft sensor model development using multirate measurements" (Accepted for IFAC World congress (2017))
2. $^{\gamma}$ L. Fan, , K. Hariprasad, B. Huang, "Robust identification of switching Markov ARX models using EM algorithm" (Accepted for IFAC World congress (2017))
3. $^{\gamma}$O. Wu, K Hariprasad, B. Huang , F.J. Forbes, "Identification of Linear Dynamic Errors-In-Variables Systems with a Dynamic Uncertain Input Using the EM Algorithm" (Accepted to 55^{th} IEEE Conference on Decision and Control (CDC 2016), Las Vegas, Nevada)
4. $^{\alpha}$ S.V.Vignesh, K. Hariprasad, S. Bhartiya,"An optimization-driven novel operation of Simulated moving bed chromatographic separation", (Accepted to IFAC Dycops-Cab 2016, Trondheim, Norway)
5. $^{\beta}$ G. Sharma, S.V.Vignesh, K. Hariprasad, S. Bhartiya, "Control-Relevant Multiple Linear Modeling of Simulated Moving Bed Chromatography", in 9th International Symposium on Advanced Control of Chemical Processes,Whistler, Canada (ADCHEM 2015, IFAC-PapersOnline),pp. 477-482.

6. $^{\beta}$ K. Hariprasad and S. Bhartiya, "Adaptive robust model predictive control of nonlinear systems using tubes based on interval inclusions", in 53rd IEEE Conference on Decision and Control (CDC), Los Angeles, California, pp. 2032-2037.
7. $^{\beta}$ K. Hariprasad and S. Bhartiya, "A computationally efficient stabilizing model predictive control of switched systems, in 3rd International Conference on Advances in Control and Optimization of Dynamical Systems, IIT Kanpur, India (ACODS 2014 IFAC-PapersOnline), vol. 3, pp. 607 - 613, 2014.
8. $^{\beta}$ K. Hariprasad and S. Bhartiya, "A dual-terminal set based robust tube mpc for switched systems", in 10th International Symposium on Dynamics and Control of Process Systems, IIT Bombay, Mumbai, India (DYCOPS 2013, IFAC-PapersOnline), vol. 10, pp. 93 98, 2013 (Won best paper award in the session) (2 citations).
9. $^{\alpha}$ P. Athawale, K. Hariprasad, S. Vinod, S. Bhartiya, "Optimal operating strategies for SMBC" Dynamics and control of chemical process (DYCOPS), IIT Bombay, Mumbai, India (DYCOPS 2013, IFAC-PapersOnline), 457-562.
10. $^{\alpha}$ K. Hariprasad, S. Bhartiya, and R. Gudi, "A multiple linear modelling appproach for nonlinear switched systems",in 8th International Symposium on Advanced Control of Chemical Processes, Singapore (ADCHEM 2012, IFAC- PapersOnline), vol. 8, pp. 63 68, 2012.

Recent submissions

1. $^{\delta}$K. Hariprasad, R. Raveendran , B. Huang, "Mixtures of Probabilistic Principal Component Analyzers with Common Structure for Latent Bases for Process Monitoring" (Submitted to IEEE Transactions on Control System Technology for review (2017))

Manuscripts in preparation

1. $^{\delta}$M. Fang, K. Hariprasad , B. Huang, "A novel approach to operating mode diagnosis using conditional random fields" (In preparation)
2. $^{\delta}$ Z. Liu, K. Hariprasad, A. Artin, B. Huang, "Dynamic Prediction of Interface Level Based on Spatial Temporal Markov Random Field" (In preparation)
3. $^{\delta}$R. Raveendran ,K. Hariprasad, B. Huang, "Process monitoring using generalized probabilistic latent variable models" (In preparation)
4. $^{\gamma}$O. Wu, K. Hariprasad, B. Huang, F.J. Forbes, "Identification of LPV Error-In-Variables systems with a dynamic process for the noise-free input using the EM algorithm"(In preparation)
5. $^{\beta}$K. Hariprasad and S. Bhartiya, "A multiple model based adaptive robust MPC based on tubes" (In preparation)

Non-refereed conferences

1. $^{\delta}$Z. Liu, K. Hariprasad, A. Artin, F. Ibrahim, B.Huang, "Application of Markov random field bases image segmentation for oil-water interface detection, To be presented at $66th$ Canadian Chemical Engineering Congress 2016, Quebec city.
2. $^{\gamma}$O. Wu, K. Hariprasad, B. Huang, F.J. Forbes, "Identification of Errors-In-Variables system with a dynamic process for the noise-free input using the EM algorithm", $65th$ Canadian Chemical Engineering Congress 2015, Calgary.
3. $^{\beta}$K. Hariprasad , S. Bhartiya, R. D.Gudi, "A multiple model approach based on trajectory linearization for non linear hybrid dynamical systems", Research Scholars' Symposium, IIT Bombay, India.

4. $^{\beta}$K. Hariprasad , S. Bhartiya, “A computationally efficient model predictive control of switched systems", Chemference 2013, IIT Bombay and ICT Mumbai, India.

Patents

1. K. Hariprasad, S. Bhartiya, “Simulated Moving Bed Chromatographic Apparatus", Indian patent filed no. 1947/MUM/2015 (Published)
2. S.V. Vignesh, K. Hariprasad, S. Bhartiya, “Serial flow continuous separation process for enhancing key component purity", Indian patent filed no. 2602/MUM/2015 (Published)

Teaching responsibilities

2017 Instructor for the course CHE 358: Process Data Analysis at University of Alberta for the winter term January-May

- Course contents: Basics of probability distributions, Hypothesis tests, Fundamental of statistical analysis, Multivariate linear regression analysis, Nonlinear regression analysis, Design of experiments, Analysis of variance, Response surface method

2009-2014 Teaching assistant for the following courses at IIT Bombay. Tasks were conducting tutorials, grading assignments and exam papers and help students in formulating and solving course projects.

- Courses: Process Control Laboratory (UG) (2 terms),Process Modeling and Identification (PG), Mathematical and statistical methods in Chemical Engineering (PG) (2 terms), Optimization (PG), Nonlinear systems analysis (PG)

Presentation given international conferences

Dec 2014 53^{rd} IEEE Conference on Decision and Control (CDC), Los Angeles, California, USA

March 2014 IFAC International conference on Advances in Control and Optimization of Dynamical Systems (ACODS), IIT Kanpur, India

Dec 2013 IFAC International conference on Computer Applications in Biotechnology (CAB) and Dynamics and Control of Chemical Process (DYCOPS), IIT Bombay, India

Workshops and seminars attended

Dec 2014 Attended a workshop on “Recent advances in modeling and control for Diabetes treatment" at CDC 2014, Los Angeles.

Apr 2008 Participated in a workshop on “Fault Diagnosis and Applications" at NIT Trichy.

Apr 2008 Participated in a workshop on “Fault Diagnosis and Applications" at NIT Trichy.

Feb 2008 Attended a workshop on“Multivariable Control Systems" at NIT Trichy.

Feb 2008 Participated in a workshop on “Nonlinear Control Systems" at NIT Trichy.

Jan 2008 Attended a workshop on “Micro-reaction Technology for Process Intensification" at NIT Trichy.

Jan 2007 Attended a pre-conference tutorial on “Nano-neuro-bio and info technologies, MEMS, NEMS and neurosurgery" at NIT Trichy.

Positions of responsibilities

2014-present Reviewer of IEEE Transactions on Autoamtic Control, COntrol Engineering Practice, IEEE CDC, IEEE ACC, IFAC ACODS, IFAC World Congress

2016 Judge for presentations in Faculty of Engineering Graduate Research Symposium, University of Alberta

2013 Volunteer of 2013 IFAC conference on Dynamics and Control of Chemical Process (DYCOPS) and IFAC conference on Computer Applications in Biotechnology (CAB), IIT Bombay, India

2012-2014 Web design and maintenance of Prof. Sharad Bhartiya research group, Department of chemical engineering, IIT Bombay

2011 Organizing member of Research Scholars' Symposium 2011, a national level research symposium, Chemical Engineering Department, IIT Bombay

2011 Web designer for Research Scholars' Symposium 2011, a national level research symposium, held at IIT Bombay

Scholastic achievements

2015 Institute award for excellence in PhD thesis, IIT Bombay

2015 R G Manudhane award for excellence in PhD thesis, IIT Bombay

2013 Secured Best paper award in Session II, Process Control and Optimization, DYCOPS 2013

2011 Secured best poster award in Research Scholars' Symposium 2011, Chemical Engineering Department, IIT Bombay

Co-curricular achievements

2011 Secured 2nd position in Photography competition at PG Cultural competition 2011, IIT Bombay

2002 President's scout award from the President of India

2000 Governor's scout award from the Governor of Kerala

1999 Selected and trained as part of the Promotion of Excellence among the gifted children conducted by General Education Department, Govt. of Kerala

Skills

- *Hardware proficiency:* National Instruments data acquisition interfacing cards (PCI, PXI and USB based), ADVANTECH ADAM Ethernet I/O cards
- *Programming languages* : PYTHON, C
- *Scientific software packages* : MATLAB, LABVIEW, R, GAMS
- *Other packages* : Joomla and Drupal for web design

References

I	II	III
Prof. Sharad Bhartiya	Prof. Ravindra D Gudi	Prof. Biao Huang
Professor	Professor	Professor
Dept. of Chemical Engg.	Dept. of Chemical Engg.	Dept. of Chemical and Materials Engg
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Declaration

I hereby declare that all the particulars furnished above are correct and complete to the best of my knowledge and belief, and I am in possession of the documents to support the above claims.

Hariprasad K

Last updated: June 2017