

# Mohammad Kargar

BSc, MSc, PhD, Faculty of Electrical and Electronic, Islamic Azad University-Najafabad Branch, Isfahan, Iran

Kargar@pel.iaun.ac.ir [Website](#) Google Scholar

## Research Interests

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- **Buildings Energy Control**
  - Indoor Environmental Control
  - Building to Grid Integration in smart cities
  - Building energy conservation
  - Building energy forecasting
  - Identifying the air temperature system in a building
  - Outside temperature and electricity prices forecasting
  - Reducing peak demands on grid resources
  - Building Management System
- **Fault Detection and Identification**
  - Model-based fault diagnosis methods( Parity Space, Unknown Input Observer, and Sliding Mode Observer)
  - Data-based fault diagnosis methods(Principal Component Analysis, principal Component Analysis and Singular Value Decomposition, Fuzzy logic, Neural Networks, Graph theory approach)
  - Deep Learning-Based Fault Diagnosis Methods
  - Data-driven fault detection for Air Handling Unit
  - Reliability, Maintainability, Availability
- **Modeling and System Identification**
  - Time Series Artificial Neural Network (ANN) model
  - Determination of a model structure
  - Parameter Estimation
  - Model Validation
  - System Identification for Building Thermal Systems Process Modeling
- **Model Predictive Control**
  - Batch and Recursive Approach
  - Generalized Predictive Control, Dynamic Matrix Control, Model Algorithmic Control
  - Stability and Feasibility Analysis
  - Stabilizing Model Predictive Control for Chemical process
  - Nonlinear Model Predictive Control
- **Machine learning / Deep Learning**
  - Convolutional neural network
  - Supervised/ Unsupervised learning
  - Classification
  - Data Augmentation
  - Dimensionality reduction
  - Feature Extraction
- **Fault Tolerant Control**
  - Integrated Nonlinear Model Predictive
  - Stability assurance
  - Active Fault-Tolerant Control
- **Optimization**
  - Convex Optimization
  - Interior Point
  - Simplex
  - Constrained and Unconstrained Finite Time Optimal Control

## Professional Experience

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- **Islamic Azad University-Najafabad Branch, Najafabad, Isfahan**  
Assistant Professor (*Faculty of Electrical and Electronic Engineering*)

Iran  
2009-Present

- Teaching at graduate level: design, delivery and examination, Fault tolerant control and Fault diagnosis system (run of module designed from scratch), Model Predictive Control (run of module designed from scratch), Linear and Nonlinear Programming (run of module designed from scratch), Industrial Automation (run of module designed from scratch), active and passive systems in buildings, Control of electrical and mechanical equipment of buildings.
- Teaching at undergraduate level: design, delivery and examination, Linear Control Systems, Operation Research, Industrial Control, Digital and Nonlinear Control, Modern Control, English for Engineering, Instrumentation.

- Research: focusing on Fault-tolerant control and fault detection, Deep learning, and Building Energy Control.
  - Approved funding bids from three national granting bodies.
  - Administration: Head of the Robotics Institute, Director of the Instrumentation and Industrial Automation Department at the Smart Microgrid Research.
  - Supervision of three Ph.D. candidates and thirteen MSc students.
- **“Arshan smart home” Knowledge enterprise, settled at Isfahan Science and technology town** Iran  
CEO and co-founder 2016-2022
    - *Building Management System (BMS)*: instructor and developing curriculum, a training course in Technical & Vocational Training Organization, Isfahan, Iran, 05/2018.
    - *Intelligent home*: instructor, Training course, IEEE IAUN Student Branch, 06/2016.
    - *Design and implementation prototype a smart home*: approved by scientific commit of Isfahan Science and technology town, Iran.
  - **Daneshpajooan University** Iran  
Part-time Lecturer of Electrical Engineering 2007-2009
    - Teaching in undergraduate level: Mathematics for Engineering, Electrical Circuits, Linear Control System

## Qualifications

- **Islamic Azad University, Science And Research Branch, Tehran** Iran  
Ph.D. in Electrical and Electronic Engineering /Control Engineering, supervised by Prof. Karim Salahshoor 2008 - 2013
  - Fault-Tolerant Nonlinear Model Predictive Control and Its Application to Chemical Processes
  - Research resulted in 3 publications in top-ranked venues and journals.
  - GPA: 17.80 /20, Thesis grade: 18.5 /20, **Ranked first**.
- **Islamic Azad University-Najafabad Branch, Isfahan** Iran  
M.Sc. in Electrical and Electronic Engineering /Control Engineering ,supervised by Dr. Saeed Hossein Nia 2006 - 2008
  - Gain scheduling Control of wind turbine systems with representation of the LPV *model*
  - Research resulted in 2 Conference publications.
  - GPA: 18.75 /20, Thesis grade: 19.25 /20, **Ranked first**
- **Shahrekord University, Shahrekord** Iran  
B.Sc. in Electrical and Electronic Engineering /Electronic Engineering, supervised by Dr. Saeed Hoghooghi 2001 - 2006
  - Designing a car automation system using PLC

## Publications

Book .....

- *Smart building systems*, **SM. Kargar**, Maziar jamshidi. Islamic Azad University of Najafabad Publication, 2017.

Peer-Reviewed Journal Articles.....

- UAV Attitude Sensor Fault Detection Based On Fuzzy Logic and by Neural Network Model Identification. M Hadidi, **SM. Kargar**, Journal of Control, 15(4), 71-83,(2022), [http://ioc-isice.ir/browse.php?a\\_id=743&sid=1&slc\\_lang=en](http://ioc-isice.ir/browse.php?a_id=743&sid=1&slc_lang=en).
- *Design and fabrication of a device for reducing hand tremor in Parkinson patients during eating*. F Talaei, **SM. Kargar**, Journal of Medical Signals and Sensors, Accepted for Publication, (2022). (Accepted).
- *System identification using NARX and centrifugal compressor control through the intelligent, active method—Case study: K-250 centrifugal compressor*. A, Khosravi, A. Chatraei,G. Shahgholian, **SM. Kargar**, Asian Journal of Control, (2022), <https://doi.org/10.1002/asjc.2799>.
- *Design of fault tolerant system using model predictive control and model-based fault identification for a chemical reactor*. **SM. Kargar**, Raeiisi M., Journal of Intelligent Procedures in Electrical Technology. 13(49), 21-39, (2022), [http://jipet.iaun.ac.ir/article\\_681232.html](http://jipet.iaun.ac.ir/article_681232.html).
- *An overview of the surge phenomenon and its control in the compressor*. Khosravi, A., Chatraei, A., Shahgholian, G., & **SM. Kargar**, Journal of Intelligent Procedures in Electrical Technology, 13(50), 1-30, (2022), [http://jipet.iaun.ac.ir/article\\_681119.html](http://jipet.iaun.ac.ir/article_681119.html).
- *Simultaneous fault localization and detection of analog circuits using deep learning approach*. A Moezi, **SM. Kargar**, Computers & Electrical Engineering, 92, (2021), <https://doi.org/10.1016/j.compeleceng.2021.107162>.

- *Fault isolation of analog circuit using an optimized ensemble empirical mode decomposition approach based on multi-objective optimization.* A Moezi, **SM. Kargar**, Proceedings of the Institution of Mechanical Engineers, Part I: Journal of Systems and Control Engineering. 235(9), 1555-1570, (2021), <https://doi.org/10.1177/09596518211020534>.
- *Fuzzy modelling of combustion efficiency and control of excess air flow case study: 320-MW steam unit/Isfahan Power Plant/Iran.* A Kermani, **SM. Kargar**, Clean Energy, 5(2), 229–242, (2021), <https://doi.org/10.1093/ce/zkab005>.
- *Model-based fault tolerant control and fault isolation through bipartite graph approach.* J Taheri, **SM. Kargar**, International Journal of Modelling, Identification and Control, 37 (3-4), 354-365, (2021), [10.1504/IJMIC.2021.121840](https://doi.org/10.1504/IJMIC.2021.121840).
- *The control of centrifugal compressor surge using a recycle valve.* A Khosravi, A Chatraei, G Shahgholian, **SM. Kargar**, Iranian Electric Industry Journal of Quality and Productivity 10 (3), 14-25, (2021), <http://ieijqp.ir/article-1-790-en.html>.
- *Modeling of K-250 Compressor Using NARX and Hierarchical Fuzzy Model.* A Khosravi, A Chatraei, G Shahgholian, **SM. Kargar**, Nashriyyah-i Muhandisi-i Barq va Muhandisi-i Kampyutar-i Iran, 81 (3), 191, (2021), <https://rimag.ricest.ac.ir/en/Article/28549>.
- *Fault detection and diagnosis in air handling using data-driven methods.* A Montazeri, **SM. Kargar**, Journal of Building Engineering, 31, 101388, (2020), <https://doi.org/10.1016/j.jobe.2020.101388>.
- *Integrated model predictive fault-tolerant control, and fault detection based on the parity space approach for a reverse osmosis desalination unit.* R Mehrad, **SM. Kargar**, Transactions of the Institute of Measurement and Control. 42(10), 1882-1894, (2020), <https://doi.org/10.1177/0142331219898942>.
- *Robust model predictive control for a small reverse osmosis desalination unit subject to uncertainty and actuator fault.* R Mehrad, **SM. Kargar**, Water Science and Technology-Water Supply, 20(4), 1229–1240, (2020), <https://doi.org/10.2166/ws.2020.043>.
- *Integrated nonlinear model predictive fault tolerant control and multiple model-based fault detection and diagnosis.* **SM. Kargar**, K Salahshoor, MJ Yazdanpanah, Chemical Engineering Research and Design, 92(2), 340-349, (2014), <https://doi.org/10.1016/j.cherd.2013.07.028>.
- *Multiple model-based fault detection and diagnosis for nonlinear model predictive fault-tolerant control.* **SM. Kargar**, K Salahshoor, MJ Yazdanpanah, Arabian Journal for Science and Engineering, 39(10), 7433-7442, (2014), <https://doi.org/10.1007/s13369-014-1252-y>.
- *Integration of multiple model-based fault detection and nonlinear model predictive fault-tolerant control.* **SM. Kargar**, K Salahshoor, MJ Yazdanpanah, IEEE Transactions on Electrical and Electronic Engineering, 10(5), 547-553, (2015), <https://doi.org/10.1002/tee.22118>.
- *Mathematical modeling and designing PID controller for a Quadrotor and optimize its step response by Genetic Algorithm.* Sabzevari, D., **SM. Kargar**, and Zanjani, S. M., Majlesi Journal of Electrical Engineering, 10(4), 17–24, (2016).
- *Adaptive Laguerre Filters for Elimination of Power Line Noise from EMG Signals: Fixed and Fuzzy Step Size Approaches.* M Malboubi, **SM. Kargar**, SA Mousavi, Majlesi Journal of Electrical Engineering, 6(4), (2012).
- *Control of Indoor Environmental Conditions Based on the Model and Use of Predictive Control Method,* A Alizadeh, **SM. KARGAR**, Journal of Intelligent Procedures in Electrical Technology. 11(44), 21-35, (2021), [http://jipet.iaun.ac.ir/article\\_675766.html](http://jipet.iaun.ac.ir/article_675766.html).
- *Automatic Generation Control of Multi-Area Power System Using a Fuzzy Wavelet Neural Network Load Frequency Controller Combined with Shuffled Frog Leaping Algorithm.* L Esteki, AA Zamani, **SM, Kargar**, SA Mousavi, Majlesi Journal of Electrical Engineering, 7(4), 55-63, (2013).
- *Modeling Distillation Column Using ARX Model Structure and Artificial Neural Networks.* R Pirmoradi, **SM. Kargar**, AZ Bidaki, Journal of Intelligent Procedures in Electrical Technology JIPET), 3 (10), 66-71, (2012).
- *Compensation of actuator's saturation by using fuzzy logic and imperialist competitive algorithm in a system with PID controller.* A.A. Zamani, **SM.Kargar**, Journal of Intelligent Procedures in Electrical Technology, 3 (11), 21-26, (2013).
- *Fuzzy Controller Design with Imperialist Competitive Algorithm for the Compressor System with Gas Turbine.* **SM. Kargar**, Abas Ali Zamani, Masoud Mohamadi, Seyed Ali Mousavi, mechatronic journal of majlesi, 1(2), (2012).
- *Velocity Control of an Electro Hydraulic Servo System Using Fuzzy Controller Based on FEL Method.* ARZ Bidaki, Y Valehsaber, **SM. Kargar**, M Aliyari, Majlesi Journal of Mechatronic Systems, 1(4), (2012), <http://journals.iaumajlesi.ac.ir/ms/index/index.php/ms/article/view/32>
- *Using Feedback Error Learning for Control of Electro Hydraulic Servo System by Laguerre.* Bidaki AR, Malboubi M, **SM. Kargar**, Deli MA, Journal of Intelligent Procedures in Electrical Technology, (2012), [https://journals.iau.ir/article\\_551144\\_b362a1b5108358f4617acbe1cc6b1f1d.pdf](https://journals.iau.ir/article_551144_b362a1b5108358f4617acbe1cc6b1f1d.pdf)
- *Designing Classic and Model Predictive Control for Nonlinear Continuous Stirred Chemical Reactors and Comparing Their Performance.* Mahnaz safian Juzdani, **SM. Kargar**, International Journal of Educational Advancement, 7 (1), 152-167, (2016).

Refereed Conferences.....

- *Integration of nonlinear model predictive fault tolerant control and fault detection and diagnosis*. **SM. Kargar**, Karim Salahshoor, Mohamad Javad Yazdanpanah. 21<sup>st</sup> Iranian Conference on Electrical Engineering (ICEE2013). May 14-16, 2013. Ferdowsi University of Mashhad, Mashhad, Iran.
- More than 20 conference paper in Persian.

#### Under Review.....

- Model Predictive Control of Multi-Zone Building's HVAC System with Thermal Energy Storage unit under Dynamic Electricity Pricing, *IEEE Transactions on Smart Grid*.
- Actuator fault tolerant control of Leader–follower multi-agent systems in directed networks with considering time delay. *IET Control Theory & Applications*.
- Optimization-based model predictive control of building energy systems considering the time of use and different sources and loads, *Journal of Building Physics*

### Approved Funding Bids

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- **Research Grant by Health Innovation Center, Isfahan University of Medical Sciences Iran** (Role: PI, \$2400) 2019-2021  
Design and Fabrication of a Device for Reducing hand Tremor in Parkinson Patients during Eating.
- **Research Grant by Islamabad Power Plant, Iran** (Role: PI, \$7,000) 2017-2019  
Fuzzy control of boiler combustion process and evaluating its impact on the efficiency of combustion and saving energy.
- **Research Grant by Niroo Trans Sepahan Company, Iran** (Role: PI, \$6,000) 2018  
Identification of distribution transformer models in order to reduce no-load losses. extramural research
- **Research Grant Supported by Isfahan Science and Technology Town (ISTT), Iran** (Role: PI, \$2500) 2015  
Design and Implementation of smart home system.

### Advisory and Supervisor of Project

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- A model Predictive Control Approach for Building to Grid Integration based on occupancy constraint Supervisory of PhD Projects
- System Identification and Controller Implementation of a Centrifugal Compressor in Esfahan Steel Company Advisor of PhD Projects
- Model Predictive Control of Indoor Climate Systems Supervisory of M.Sc. Projects
- System identification for model-predictive building climate control and simulation using Energy plus software Supervisory of M.Sc. Projects
- Temperature Controller for Building Management System Using Weather Forecast Ontology Supervisory of M.Sc. Projects
- Faults Detection and Diagnosis of an Air Handling Unit Using Data Driven Methods Supervisory of M.Sc. Projects
- Identification System for Power Transformer Supervisory of M.Sc. Projects
- Designing a Fault-Tolerant Controller with Respect to Fault Detection Using Sliding Mode Observer Supervisory of M.Sc. Projects
- Signal Model Based Fault Detection & diagnosis Methods for UAV Sensors Supervisory of M.Sc. Projects
- Detection, Isolation and Estimation of Faults in the Sensors and Actuators Using Model-Based Methods Supervisory of M.Sc. Projects
- Fault Tolerant Controller Design Using Nonlinear Predictive Control Lyapunov-Based to compensate actuators faults. Supervisory of M.Sc. Projects
- Steam Generator Level System Control in Nuclear Power Plant Using Generalized Model Predictive Control Supervisory of M.Sc. Projects
- Model Predictive Fault-Tolerant Control of a Reverse Osmosis Desalination Plant Supervisory of M.Sc. Projects
- Fault Detection of Analog Circuit by Using Independent EEMD and Feature Selection Supervisory of M.Sc. Projects

- Model-Based Fault Detection and Isolation Using Bipartite Graph Approach Supervisory of M.Sc. Projects
- Investigation on the Fuzzy Control of the Combustion Process of a 320 MW Steam Boiler and Assessing the Impacts on the Combustion Efficiency and Fuel Saving Supervisory of M.Sc. Projects
- Fault Tolerant Control for HVAC System with Respect to Actuator Fault Supervisory of M.Sc. Projects
- Spoon Movement Control for Human Hand Tremor Cancelling in Parkinson Disease Supervisory of M.Sc. Projects
- Model predictive control of building indoor temperature considering the effect of ambient air temperature forecasting Supervisory of M.Sc. Projects
- Fault-Tolerant Control System Design Using Prediction Control Approach and Fault Detection Model-Based of Chemical Reactor Supervisory of M.Sc. Projects
- Sliding Mode Control of Pneumatic Actuator Supervisory of M.Sc. Projects
- Model predictive control of building indoor temperature considering the effect of ambient air temperature forecasting Supervisory of M.Sc. Projects

## Academic Services

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### • Reviewer for

- IEEE Transactions on Industrial Electronic
- IEEE Transactions on Control Systems Technology
- IEEE Transactions on Smart Grid
- Proceedings of the Institution of Mechanical Engineers, Part D: Journal of Automobile Engineering
- Asian Journal of Control
- International Journal of Adaptive Control and Signal Processing
- National Electrical Engineering Conference (NEEC).
- The Iranian Student Conference on Electrical Engineering (ISCEE).
- IEEE Transactions on Neural Networks and Learning Systems
- International Journal of Applied Mathematics and Computer Science (AMCS).
- IEEE Access
- Proceedings of the Institution of Mechanical Engineers, Part I: Journal of Systems and Control Engineering
- Journal of medical signals and sensors (JMSS)
- JIPET (Journal of Intelligent Procedures in Electrical Technology).
- International Journal of Industrial Electronics Control and Optimization

### • Committee/ Editorial board Member/ Memberships

- Head of the Instrumentation and Industrial Automation Department, Smart Microgrid Research Center, Islamic Azad University-Najafabad Branch, Isfahan, Iran, 2019-2022
- Secretary of the Scientific Committee in “National Electrical. Engineering Conference” (NEEC), Isfahan, Iran, 2022.
- Member of the Scientific Committee, “The first robotic competition”, Shahin-Shahr, Isfahan, Iran, 2013.
- Secretary of the Scientific Committee in “National Electrical. Engineering Conference” (NEEC), Isfahan, Iran, 2011
- Secretary of the Scientific Committee in “National Electrical. Engineering Conference” (NEEC), Isfahan, Iran, 2018
- Secretary of the Scientific Committee in “New technologies in the appliance industry Conference”, Isfahan, Iran, 2012)
- Member of Iran's National Elites Foundation (INEF)

### • Invited Presentation

- Smart home energy saving system, Key speaker, Nonprofit institution Sepehr Isfahan, 1st National Smart City Conference, June 2015, 50 minutes.
- Building Management System in ZEB, Key speaker, Islamic Azad University of Dolatabad- Isfahan- Iran.90 minutes.

## Awards and Honours

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- **First Ranked among Graduating Students in M. Sc.**, Islamic Azad University-Najafabad Branch, Isfahan, Iran. 2008.
- **First Ranked in National PhD Entrance Exam**, Islamic Azad University-Science and Research Branch, Tehran, Iran. 2008.

- **First Ranked among Graduating Students in PhD** Islamic Azad University-Science and Research Branch, Tehran, Iran. 2013.
- **First Ranked in the Third National Kharazmi Robotic Competitions and second international Robotic Tournament**, Amirkabir University of Technology (Mars Rover section), ATTCUP2010, Tehran, Iran.

### Technical, Teaching & Language Skills

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- **Operating Systems:** MAC OS, MS Windows.
- **Programming:** MATLAB, Python, CPLEX, YALMIP(Optimization Toolbox), Design Builder, LaTeX, etc.
- **Languages:** English, Farsi.