

# Hamid Khoshkhoo, Ph.D.

Associate Professor in Electrical Power Engineering

## CONTACT INFORMATION

Faculty of Electrical Engineering, Sahand  
University of Technology, Tabriz 5331817634,  
Iran

Phone: +989126420887

E-mail: [hamid.khoshkhoo@gmail.com](mailto:hamid.khoshkhoo@gmail.com)

## SUMMARY

- Over 15 years of experience in power systems analysis for Low, Medium, and High voltage applications,
- Supervisor of 11 M.Sc. and 2 Ph.D. candidates,
- Extensive knowledge of power system component modeling, e.g. generator's controllers, photovoltaic resources, wind turbines, energy storage systems, etc.,
- Hands-on experience in development and simulation of control strategies for power electronic systems such as DC/DC converters, MPPT/OPPT, DC/AC inverters, and synchronverters,
- Specialized in power system large-disturbance (voltage/rotor angle/frequency) and small-disturbance (modal) stability assessment,
- Extensive research and development experience in proposing remedial action schemes to prevent dynamic instability of power systems,
- Proficient in utilizing large scale photovoltaic resources in improving power system stability status,
- Proficient in power system protection coordination,
- Vast knowledge of machine learning, reinforcement learning, and optimization techniques such as Genetic Algorithm,
- Extensive experience with DIgSILENT PowerFactory: Performing large (voltage/rotor angle/frequency) and small-disturbance (modal) stability assessment; Modelling of generators controllers (AVR, governor, PSS), photovoltaic resources, and synchronverter in DSL environment; Implementation and simulation of protective relays; DPL and Python coding,
- Wrote a book (in Persian): "Basics of Power Systems Protection; with Modelling and Practical Examples in PowerFactory" [Awarded as the author of the year at the Sahand University of Technology in 2022].
- Wrote three book chapters (in Springer publication) about analyzing the impact of large-scale photovoltaic resources on power system dynamic stability using PowerFactory, and implementation of the power management system (PMS) in PowerFactory to simulate smart grids functionalities of PMS.

## COMPUTER SOFTWARE/ PROGRAMMING LANGUAGES

- DIgSILENT PowerFactory (including DPL, DSL; RMS, EMT, Modal analysis; DPL and Python coding)
- PSCAD, PSSE
- MATLAB programming and Simulink, PSAT
- CYMTCC, PSAF
- C++, Delphi
- Microsoft Office/LATEX

## LANGUAGE SKILLS

- Persian
- English (IELTS General Training overall Band: 7)
- Turkish

# R&D AND CONSULTANCY EXPERIENCES

Sahand University of Technology

January 2015- Present

Associate Professor, Power System Engineering Department

**CONSULTANCY SERVICES** • **Granted a six-month industrial research position to diagnose and provide a solution on the topic of "Network Restoration" for one of the Iranian network service providers (NSPs); Iran Electrical Clinic. July 2021 – January 2022**

- **Assessment and Improvement of Voltage Stability Status in Power Systems-Phase II**

**Contract number: 12869**

**Sponsor: Niroo Research Institute**

This project is sponsored by the Niroo Research Institute (NRI) subsidiary of the Iranian Ministry of Power. As a principal investigator, I have conducted several power system studies for NRI. The scope of this work includes:

- Asset management and power system component modeling
- Proposing a novel stability index for power transmission systems
- Proposing a novel Power Management System for stability maintenance in industrial sectors
- EMT analysis
- RMS analysis

This project started in June 2020 and was completed in September 2021. This project has been delivered to NRI, Iran.

- **Assessment and Improvement of Voltage Stability Status in Power Systems-Phase I**

**Contract number: 6627**

**Sponsor: Niroo Research Institute**

This project is sponsored by the Niroo Research Institute (NRI) subsidiary of the Iranian Ministry of Power. As a principle investigator, I have performed an extensive investigation and determined the required studies for assessment and improvement of voltage stability phenomena in the Iranian power system.

The scope of this work includes analyzing the drawbacks of current voltage stability assessment as well as improvement methods, and determining the required characteristics of voltage stability assessment and improvement methods considering the practical limitations.

This project started in July 2019 and was completed in May 2020. This project has been delivered to NRI, Iran.

- **Proposing a Novel Line Stability Index for Voltage Stability Assessment**

**Contract number: 25003**

**Sponsor: Azerbaijan Regional Electric Company**

As a principal investigator, using DIgSILENT PowerFactory and Matlab software, I have performed dynamic voltage stability assessment, time domain simulations, and proposed and verified a line stability index to assess power system stability status using data measured by SCADA and/or PMU.

This project started in Feb. 2020 and completed in May 2020. This project has been delivered to Azerbaijan Regional Electric Company, Iran.

- **Dynamic Voltage Stability Assessment considering the effect of protection system**

**Contract number: 30/20252**

**Sponsor: Sahand University of Technology**

As a principal investigator, I have proposed and verified a novel algorithm to predict the dynamic voltage stability of power systems considering correct or incorrect operation of the protection system which leads to the operation of the power system in N-1 and N-k conditions, respectively. In this project, the required time domain simulations are carried out using DIgSILENT PowerFactory and Matlab software. This project started in Feb. 2018, was completed in May 2019, and delivered to Sahand University of Technology.

## **R & D PROJECTS**

- **A SPS to Prevent Transient Rotor Angle Instability**

August 2020 - Dec. 2022

As a principle investigator, I have designed and verified an innovative special protection system (SPS) to perform timely and optimal remedial actions based on the data measured by WAMS to prevent transient rotor angle instability. The efficiency of the proposed method has been verified through several dynamic simulations performed in Nordic32, IEEE 118-bus, and PST 16 test systems using DIgSILENT PowerFactory software.

- **Adaptive Regulation of LSPVPPs' Reserve to Enhance Power System Voltage Stability,**

October 2020-December 2020

As a principle investigator, I have designed and verified an innovative remedial action scheme that adaptively regulates the active power reserve of large-scale photovoltaic power plants (LSPVPP) to enhance power system voltage and frequency stability against major disturbances. The efficiency of the proposed algorithm has been validated through several dynamic scenarios performed in IEEE 14-bus, IEEE 39-bus, IEEE 118-bus, and Nordic32 test systems using DIgSILENT PowerFactory software.

- **Inter-Area Oscillations Damping Using Synchronverter-based Control Algorithm for LSPVPP**

June 2020-November 2020

I have conducted the Study, modeled and implemented synchronverter control model for large scale photovoltaic power plants (LSPVPP) to damp inter-area oscillations. The efficiency of the method was validated through dynamic simulations performed in the Kundur power system as well as the transmission network of Zanzan Regional Electricity Company using DIgSILENT PowerFactory. March 2020-June 2020.

- **A SPS to Prevent Mid-term and Long-term Voltage Instabilities**

Oct. 2018 - Oct. 2019

As a principle investigator, I have designed and verified an innovative special protection system (SPS) to execute efficient remedial actions to prevent mid-term and long-term voltage instabilities in power systems. The efficiency of the proposed algorithm was validated through several scenarios performed in Nordic32, and PST 16 test systems using DIgSILENT PowerFactory software. This project has been performed with collaborators from the Center for Research on Microgrids (CROM) Aalborg University, Denmark, and Power Quality Research Center, UNITEN, Malaysia.

- **A Novel Generation Equivalence Index to assign low-order models to synchronous generators**

March 2017- February 2018

I have proposed and verified a novel Generation Equivalence Index (GEI) to identify those synchronous generators that can be presented by low-order models in dynamic voltage stability assessment when an outage occurs. Several dynamic simulation results performed in Nordic32, IEEE 39-bus, and IEEE 118-bus test systems using DIgSILENT PowerFactory software verify the efficiency of the proposed approach. This project has been performed with collaborators from the Center of Excellence for Power Systems Automation and Operation, Iran University of Science and Technology, Tehran, Iran.

- **Fast Prediction of Angle Stability Fault Duration Data**

December 2016- March 2017

I have Designed and verified an innovative prediction method for the transient stability of power systems using only pre-fault and fault duration data measured by the Wide Area Measurement System. The efficiency of the proposed index was validated through various dynamic simulations performed in IEEE 14-bus, IEEE 39-bus, 16-Machine (68-bus), and IEEE 118-bus test systems using DIgSILENT PowerFactory and MATLAB software.

- **Proposing an Improved line stability index**

September 2016-January 2017

I have carried out a comprehensive assessment of line stability indices and also, proposed and verified a modified line stability index to accurately assess the voltage stability status of networks in different situations. The efficiency of the proposed index was validated through several static and dynamic scenarios performed in IEEE 39-bus, and 118-bus test systems using DIgSILENT PowerFactory and MATLAB software.

- **Dynamic Stability Improvement of Islanded Power Plant by PMS**

Feb. 2016-August 2016

As a principle investigator, I have conducted the study and proposed under-voltage load shedding and under frequency load shedding functions of Power Management System (PMS) in a real petrochemical power plant. The effectiveness of the load shedding schemes against major contingencies is verified through several dynamic scenarios performed using DIgSILENT software.

## **Iran University of Science and Technology**

### **Electrical Design Engineer**

#### **CONSULTANCY SERVICES**

- **Coordination of Protection Relays in the 20 kV Network of Almahdi Aluminum Company, 2011-2012**

As a principal investigator as well as the administration manager, I have proposed Overcurrent Relays Settings and CT's characteristics in Almahdi Aluminum Company using PSAF and CYMTCC software (the largest and most advanced manufacturer of pure aluminum ingots in Iran).

- **Assessment and improvement of switching overvoltages in Bakhtar Regional Electric Company, Iran, 2009-2010**

I have analyzed the possibility of switching overvoltages in Bakhtar Regional Electric Company, Iran, and proposing appropriate approaches to minimize the effect of switching overvoltages. In this project, EMTP-

RV software has been used to carry out electromagnetic simulations.

## ACADEMIC EXPERIENCE

**TEACHING EXPERIENCE** **Assistant (and then associate) professor** at the Sahand University of Technology, 2015 till now. The courses taught are as follows:

- Protection and Relays;
- Advanced Power System Protection;
- Electrical Machines and Drives (III);
- Power System Dynamic and Stability (I)
- Electrical Machine Lab (I);
- Electrical Machine Lab (II);
- Electrical Circuits and Measurements Lab.

**Adjunct Lecturer** at Iran Azad University, February 2014 to January 2015. The courses taught are as follows:

- Electrical Machines and Drives (I);
- Electrical Machines and Drives (III);
- Protection and Relays.

**Teaching Assistance** at the University of Zanjan, February 2004 to June 2005. The courses taught are as follows:

- Engineering Mathematics;
- Electromagnetism

### ACADEMIC SERVICES

- Director of communication with industry, Faculty of Electrical Engineering, Sahand University of Technology
- Setting up Electrical Machine Lab (I) at Sahand university of technology;
- Director of laboratories of the Faculty of Electrical Engineering, Sahand University of Technology;
- Workshop presentation at "10<sup>th</sup> Smart Grid Conference" on the 17<sup>th</sup> December 2020: "An overview of the capabilities of PowerFactory software in assessing the stability status and protection system of power networks";
- Workshop presentation at "11<sup>th</sup> power systems protection & control " on the 16<sup>th</sup> January 2017: "Application of DIgSILENT PowerFactory in power system protection";
- Workshop presentation at "9<sup>th</sup> power systems protection & control" on the 14<sup>th</sup> January 2015: " Application of WAMS system in power system operation - Case study: Voltage stability";

### SCIENTIFIC EVALUATION COMMITTEES

- Reviewer -IEEE Transactions on Power Systems;
- Reviewer -International Journal of Electrical Power & Energy Systems;
- Reviewer - International Transactions on Electrical Energy Systems;
- Reviewer - Computational Intelligence in Electrical Engineering;
- Reviewer – Journal of Nonlinear Systems in Electrical Engineering;
- Reviewer – Iranian Journal of Electrical and Electronic Engineering;
- Reviewer –International Journal of Electrical and Computer Engineering.

## QUALIFICATIONS

**ACADEMIA** **Ph.D.:** Power Electrical Engineering, Iran University of Science and Technology, Iran, 2014

**Title of dissertation:** "Special Protection System Design for Voltage Instability Detection and Prediction in Power Systems"

**Synopsis:**

- A novel method for online prediction of voltage stability status using the data measured using synchrophasors measured by PMUs during a few seconds after the disturbance occurrence.
- A novel approach for fast prediction of voltage stability in both preventive and corrective remedial action schemes which only requires pre-disturbance data measured by WAMS as well as disturbance characteristics.

**M.Sc.:** Electrical Power Engineering, Amirkabir University of Technology, Iran, 2007.

**Title of thesis:** "Calculation of Inductance of Flexible Cables and Electrode Arms in an Electric Arc Furnaces for Improving Its Control System"

**Synopsis:**

- Estimation of inductance of low voltage side of electric arc furnaces (EAF) including Flexible Cables and Electrode Arms.
- Proposing a method for efficient power control of electric arc furnaces based on the inductance of low voltage side of arc furnaces.
- An efficient method for power control of EAF based on the estimation of the inductance of low voltage side of EAF to improve its efficiency.

**B.Sc.:** Electrical Power Engineering, University of Zanjan, Iran, 2005.

**Title of project:** "Analyzing the transient response of power transformers against lightning overvoltage"

## SELECTED PUBLICATIONS

**BOOK**

- **H. Khoshkhou**, "Basics of Power Systems Protection; with Modelling and Practical Examples in PowerFactory" (in Persian), 2022 [Awarded as the book of the year at the Sahand University of Technology].

**BOOK  
CHAPTERS**

- **H. Khoshkhou**, Reza Ranji Bourachalou, Aref Pouryekta, Book Chapter Title: "Integration of Large-Scale Photovoltaic Power Plants into Power Networks to Maintain System Stability", Book Title: "Modelling and Simulation of Power Electronic Converter Dominated Power Systems in PowerFactory", Green Energy and Technology, Springer, 2020.
- **H. Khoshkhou**, A. Parizad, Book Chapter Title: "Dynamic Stability Improvement of Islanded Power Plant by Smart Power Management System: Implementation of PMS Logic", Book Title: "Advanced Smart Grid Functionalities Based on PowerFactory", Green Energy and Technology, Springer, 2018.
- Ali Parizad, **H. Khoshkhou**, Book Chapter Title: "Dynamic Stability Improvement of Islanded Power Plant by Smart Power Management System: Principles, Descriptions, and Scenarios", Book Title: "Advanced Smart Grid Functionalities Based on Power Factory", Green Energy and Technology, Springer, 2018.

**ARTICLES**

- Pouria Akbarzadeh Aghdam, **Hamid Khoshkhou**, "A Novel Method to Estimate Thevenin Equivalent Circuit Using Local Measurements", 32nd International Conference on Electrical Engineering (ICEE), 2024.
- Hadi Abbaspour, Siavash Yari, **Hamid Khoshkhou**, Innocent Kamwa "Improving Transient Stability in Power Systems through Integration of Large-Scale Photovoltaic Power Plants", 9th International Conference on Technology and Energy Management (ICTEM), 2024.

- H. Abbaspour, S. Yari, E. Asadi, **H. Khoshkhou**, S. M. Ale Emran, "Determining Energy Storage Systems Capacity for Preventing Cascading Outages During Primary Control: A Dynamic Study", 13th Smart Grid Conference (SGC 2023).
- Siavash Yari, **H. Khoshkhou**, Kumars Rouzbehi, S. M. Ale Emran, "Preventing Frequency Instability Using Large-Scale Photovoltaic Resources", 8th International Conference on Technology and Energy Management (ICTEM), 2023.
- **H. Khoshkhou**, M. Khalilifar, S. M. Shahrtash "Survey of Power System Restoration Documents Issued from 2016 to 2021", International Transactions on Electrical Energy Systems, 2022.
- M. Shahriyari, **H. Khoshkhou**, Josep M. Guerrero, "A Novel Fast Transient Stability Assessment of Power Systems Using Fault-on Trajectory", IEEE Systems Journal, 2022.
- M. Shahriyari, **H. Khoshkhou**, "A Deep Learning-Based Approach for Comprehensive Rotor Angle Stability Assessment" Journal of Operation and Automation in Power Engineering, 2022.
- Pourya Akbarzadeh Aghdam, **Hamid Khoshkhou**, "Prediction of Voltage Stability Status Considering the Impact of the Protection System", Scientific Journal of Advanced Defense Science and Technology, 2022 (in Persian).
- Siavash Yari, Hamid Khoshkhou, Nasser Hosseinzadeh, "A Decentralized Remedial Action Scheme to Prevent Long-Term Voltage Instability Against N-1 and N-2 Contingencies", IEEE PES 14th Asia-Pacific Power and Energy Engineering Conference (APPEEC), 2022.
- S. Yari, M. Khaleghi, **H. Khoshkhou**, M. Akhlaghi, "Improvement of Inter Area Oscillation Damping Using Synchronverter Control Model for Solar Power Plants", Journal of Advanced Defense Science and Technology, 2021 (in Persian).
- Reza Ranji Bourachalou, **Hamid Khoshkhou**, Siavash Yari, "A new control method to prevent frequency instability using large-scale solar sources", 8th Iranian Conference on Renewable Energy and Distributed Generation (ICREDG), 2021 (selected as the best paper in this conference) (in Persian).
- Siavash Yari, **Hamid Khoshkhou**, "A New Approach to Determine Maximum Allowable Penetration Level of LSPVPPs Considering Transient Angle Stability", 29th Iranian Conference on Electrical Engineering (ICEE), 2021.
- E. Asadi, **H. Khoshkhou**, A. Parizad, "A Novel Generation Shedding Procedure for Power Management System in Industrial Power Plants", 29th Iranian Conference on Electrical Engineering (ICEE), 2021.
- **Hamid Khoshkhou**, Siavash Yari, Aref Pouryekta, Vigna K. Ramachandaramurthy, Josep M. Guerrero, "A Remedial Action Scheme to Prevent Mid/Long-Term Voltage Instabilities", IEEE Systems Journal, 2020.
- S. Yari, **H. Khoshkhou**, S.M. Shahrtash, "Generation Equivalence Index (GEI) to assign low-order models to synchronous generators in voltage security assessment based on dynamic simulation", International Journal of Electrical Power & Energy Systems, 2020.
- P.A. Aghdam, **Hamid Khoshkhou**, "A Novel Voltage Stability Assessment Algorithm to Predict Power System Loadability Margin", IET Generation, Transmission & Distribution, 2020.
- M. Shahriyari, **H. Khoshkhou**, "A Novel Approach for Fast Prediction of Transient Angle Stability Status in Power Systems", Scientific Journal of Advanced Defense Science and Technology, 2020 (in Persian).
- Siavash Yari, **Hamid Khoshkhou**, "A comprehensive assessment to propose an improved line stability index", International Transactions on Electrical Energy Systems, 2019.
- M. Shahriyari, **H. Khoshkhou**, A. Pouryekta, V.K. Ramachandaramurthy, "Fast Prediction of Angle Stability Using Support Vector Machine and Fault Duration Data", IEEE International Conference on Automatic Control and Intelligent Systems, 2019.

- Siavash Yari, **Hamid Khoshkhou**, "An Effective Corrective Remedial Action Algorithm to Prevent Voltage Instability", Conference on Knowledge Based Engineering and Innovation, 2019.
- S. Yari, **H. Khoshkhou**, "Assessment of line stability indices in detection of voltage stability status", IEEE International Conference on Environment and Electrical Engineering and 2017 IEEE Industrial and Commercial Power Systems Europe (EEEIC/I&CPS Europe), 2017.
- **Hamid Khoshkhou**, S. Mohammad Shahrtaash, "Fast online dynamic voltage instability prediction and voltage stability classification", IET Generation, Transmission & Distribution, 2014.
- **Hamid Khoshkhou**, S. Mohammad Shahrtaash, "On-line dynamic voltage instability prediction based on decision tree supported by a wide-area measurement system", IET Generation, Transmission & Distribution, 2012.
- **H. Khoshkhou**, S. H. H. Sadeghi, R. Moini, H. A. Talebi, "An efficient power control scheme for electric arc furnaces using online estimation of flexible cable inductance", Computers & Mathematics with Applications, 2011.