

Paper ID: 384-Simplified Photovoltaic and Wind Turbine Models for Phasor-Domain Simulation Studies of Renewable Dominated Power Systems.

Abstract – The high penetration rate of renewable energy resources (RESs), especially, in the form of photovoltaics (PVs) and wind turbines (WTs) has made the simulation and analysis of power systems more complex because of increased nonlinearities and uncertainties. Accordingly, electromagnetic (EMT) and phasor models have been developed well as common modeling approaches for considering characteristics of RESs into power system studies. This paper develops a simplified model to represent the characteristics of PVs and WTs in phasor domain simulation. The proposed model reduces the three-phase model of PVs and WTs to a circuit with two controlled current sources and considers the control and protection systems of these resources as well as environmental conditions effects on their output power. Simulation results and comparison study cases validate the correctness of the proposed model.

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Mehdi Bagheri (Senior Member, IEEE) received the Ph.D. degree in electrical power engineering and energy systems from the University of New South Wales (UNSW), Sydney, Australia. He was with the Electric Machinery and Drive Laboratory, Electrical Engineering Department, National University of Singapore (NUS), and closely involved with the Rolls-Royce Pte. Ltd., on a Joint Project. Since 2016, he has been with Nazarbayev University, where he currently holds the position of Professor in the Department of Electrical and Computer Engineering. He is acting Head of Department and also is the Head of the Smart Energy Systems Laboratory. He is actively involved in the advanced testing of industrial projects, and he provides technical support to multinational companies, specializing in power product manufacturing, strategic relationships between industry and academia, energy management, smart monitoring of power equipment, analysis and development of sustainable energy systems. His research interests include energy security and policy, high voltage engineering, wireless power transfer, condition monitoring and assessment, diagnosis of energy equipment in the field, space, marine applications, electrical rotating machines, electrical insulation, power quality, and smart energy systems. He was a member of the National Research Council of Kazakhstan, from 2020 to 2023. He is a member of IEEE PES, IES, and DEIS. In recognition of his contributions to engineering, he received the Scopus Award, in 2022, and in recognition of his distinguished contribution to Kazakhstan science and education, he received the "Enbegi Ushin Medal" from Kazakhstan Ministry of Science and Education, in 2024. He is an Associate Editor of IEEE ACCESS journal.