VIENNA ENERGY FORUM 2020

The Fourth Industrial Revolution as a catalyst for energy transition

Official Sessions | 16-17 June 2020 | Hofburg Palace
Back-to-Back Meetings | 15 and 18 June 2020 | Vienna International Centre

CALL FOR RESEARCH POSTERS
UNIVERSITY/R&D

Joining the Vienna Energy Forum offers an opportunity to stand on the world's preeminent platform for sustainable energy, lead the discussions on the latest technological developments for energy transition, and connect with influential global and industry leaders.

Become a catalyzer of change in defining the legacy of the Fourth Industrial Revolution.

WHO?

Universities, laboratories, researchers and other academics are welcome to submit their research posters, for their potential complimentary display in a dedicated area at the Hofburg Imperial Palace, Vienna, Austria.

WHAT?

Promote your research in the following topics:

- Leveraging the Fourth Industrial Revolution for sustainable development
- Harnessing the Fourth Industrial Revolution for small and medium enterprises
- Fourth Industrial Revolution innovation spillovers on services economy (particularly, healthcare and education)
- Economic, social and environmental indicators to determine gains from the application of Fourth Industrial Revolution technologies
- Fourth Industrial Revolution initiatives for supply chain sustainability

Present your scientific poster in the main gathering area at the Hofburg Imperial Palace
Communicate your research
Network with an impactful group of international, public and private actors throughout the Forum
** A maximum of 30 posters will be selected and showcased during the VEF 2020 proceedings.*

HOW?

Abstract submission and participation is free of charge.
Poster specifications:

- Format: 70cm x 110cm
- Orientation: Portrait
- Type: PDF file
- Language: English

VEF 2020 R&D AWARD

All posters will be evaluated by the R&D Committee. The best poster will be rewarded with the «**VEF 2020 R&D AWARD**» during the closing ceremony on 17 June at 4:00pm.

IMPORTANT DEADLINES

- Reception of contact information and abstract: 29 February 2020
  Submit information using the online form (click here)
  Include full name, email, university, poster title, and short abstract (200 words max.)
- Selected candidates will be contacted by 31 March 2020
- Digital poster reception: 20 May 2020
  If selected, send your poster in the format below and as specified in template

www.viennaenergyforum.org
For more information, please email: vef@unido.org

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IIASA International Institute for Applied Systems Analysis
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VIENNA ENERGY FORUM 2020

Paper Title (use style: Paper Title)

Authors Name/s

Author/s affiliation: e-mail, department, name of organization, city, country

I- Introduction

➢ There are several generator emulator and simulation experiments have been published in order to implement a useful basis for electromechanical control of wind turbines in literature.

➢ The squirrel-cage induction generators (SCIG) are used in both fixed and variable speed wind turbine applications due to their low costs, robustness and easy control features.

➢ In this paper, the proposed control schemes are based on converter control instead of generator in a variable speed wind turbine system as diverting the previous studies. The modeled system contains four main parts as variable voltage-variable frequency generator wind turbine model, 6-pulse sinusoidal pulse width modulation (SPWM) controlled rectifier, 3-level SPWM controlled multilevel inverter, and fuzzy logic controller model.

➢The output voltage and frequency values of generator are set to 350-700V and 40-60Hz in order to simulate variable wind speeds. The fuzzy logic controller (FLC) is intended to define the most proper switching angles by adjusting modulation index (mi) ratio of inverter. The control algorithm of FLC is dependent to input voltage and frequency values of converter and tracks the output parameter mi according to changes of generator parameters.

II. Proposed Converter and FLC System

➢The variable voltage variable frequency (VVVF) model has been constituted with three-phase programmable voltage sources in order to generate the desired variable input value of converter in Simulink.

➢The fuzzy control block has been designed to control mi value of inverter according to ΔV and Δf of SCIG.

➢The minimum voltage level has been set to 350V while the peak value was 700V.

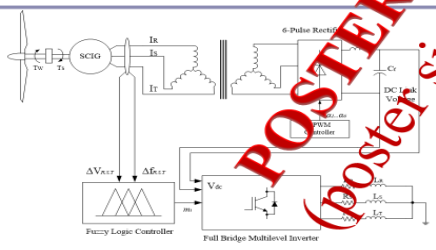

Figure 1. Block diagram of the proposed multilevel converter

➢The fuzzy controller is based on a Mamdani Fuzzy system that requires two input variables (V, f) (Fig. 2.a-b) to control output variable (mi), (Fig. 2.c) .

➢The input and output variables have seven membership functions named as VVL (very very low), VL (very low), L (low), M (medium), H (high), VH (very high), and VVH (very very high).

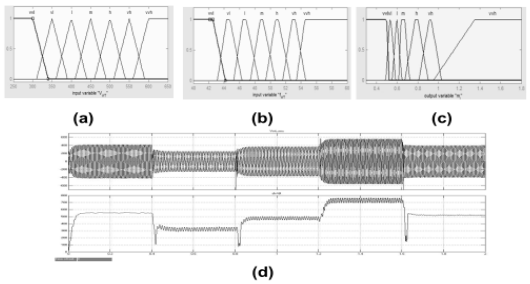

Figure 2. Fuzzy membership functions (a,b,c) and VVVF output of variable speed wind turbine model in Simulink

III. Simulation/Experimental Results

➢The three-phase variable voltage with variable frequency obtained at the output of SCIG model is illustrated in Fig. 2.d

➢The generated voltage and frequency values of generator were 500V/45Hz, 350V/42Hz, 470V/47Hz, 700V/57Hz, 500V/49Hz.

➢The output current increases to 55.6A without fuzzy control while it is decreased to 25A with FLC algorithm.

➢The THD ratio of line currents has been measured as 3.25% during 2 kHz switching and 0.03% at 5 kHz switching frequency.

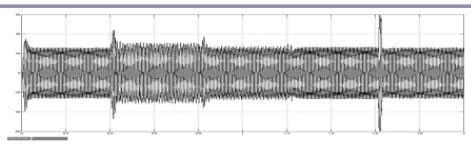

Figure 3. The output currents of AC-DC-AC converter with fuzzy logic control

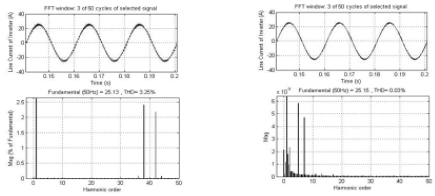

Figure 3. The THD analyzes of converter current, (a) 2 kHz switching frequency, (b) 5 kHz switching frequency

IV. Conclusion

➢In this paper, the fuzzy logic control of an AC-DC-AC converter in a variable speed wind turbine system has been modeled using Matlab/Simulink in high accuracy.

➢A fuzzy logic controller from input to output of system was designed and implemented to keep output current stable automatically and effectively under various input conditions.

➢The FLC algorithm has been prepared obtaining required modulation index at 50V/2Hz increment of input from 350V/40Hz to 700V/60Hz.

➢Although the simulation parameters were differing from measured voltage and frequency conditions, the implemented FLC algorithm was able to calculate the accurate modulation indexes.