

Accredited "A" by DGHE (DIKTI), Decree No. 080/Q/2012
and Indexed by SCOPUS (Elsevier Product)

ISSN 1693-6930

TELKOMNIKA

Telecommunication, Computing, Electronics and Control

TELKOMNIKA

Vol. 13 No. 1, March 2015



Published by
Universitas Ahmad Dahlan (UAD), Yogyakarta, Indonesia
and
Institute of Advanced Engineering and Science (IAES)




TELKOMNIKA

Telecommunication, Computing, Electronics and Control

ISSN: 1693-6930, e-ISSN: 2302-9293

Accredited First Grade by Ministry of Research, Technology and Higher Education, Republic of Indonesia, License No. 21/M/2017/DT10

 Scopus
indexed

[HOME](#) [ABOUT](#) [LOGIN](#) [REGISTER](#) [SEARCH](#) [CURRENT](#) [ARCHIVES](#)
[ANNOUNCEMENTS](#)
[Home](#) > [About the Journal](#) > **Editorial Team**

Editorial Team

Editor-in-Chief

[Dr. Tole Sutikno](#), Universitas Ahmad Dahlan, Indonesia

Editor-in-Chief for Power Engineering

[Dr. Ahmet Teke](#), Cukurova University, Turkey

Editor-in-Chief for Electronics Engineering

[Prof. Dr. Faycal Djeflal](#), University of Batna, Batna, Algeria

Editor-in-Chief for Power Electronics and Drives

[Assoc. Prof. Dr. Nik Rumzi Nik Idris](#), Universiti Teknologi Malaysia, Malaysia

Editor-in-Chief for Control Engineering

[Dr. Auzani Jidin](#), Universiti Teknikal Malaysia Melaka (UTeM), Malaysia

Editor-in-Chief for Signal Processing

[Assoc. Prof. Dr. Nidhal Bouaynaya](#), Rowan University, Glassboro, NJ, United States

Editor-in-Chief for Telecommunication Engineering

[Prof. Dr. Leo P. Ligthart](#), Delft University of Technology, Netherlands

Editor-in-Chief for Machine Learning, AI and Soft Computing

[Prof. Dr. Luis Paulo Reis](#), University of Minho, Portugal

Editor-in-Chief for Computer Science, Informatics and Information System

[Assoc. Prof. Dr. Wanguan Liu](#), Curtin University of Technology, Australia

Associate Editors

[Prof. Dr. Ahmad Saudi Samosir](#), Lampung University, Indonesia

[Prof. Franco Frattolillo, Ph.D.](#), University of Sannio, Italy

[Prof. Dr. Hussain Al-Ahmad](#), Khalifa University, United Arab Emirates

[Prof. Longguan Yong](#), Shaanxi University of Technology, China

[Prof. Ing. Mario Versaci](#), Mediterranea University of Reggio Calabria, Italy

[Prof. Dr. Mirosław Swiercz](#), Politechnika Białostocka, Poland

[Prof. Dr. Omar Lengerke](#), Universidad Autónoma de Bucaramanga, Colombia

[Prof. Dr. Srinivasan Alavandar](#), CK College of Engineering and Technology, India

[Prof. Dr. Tarek Bouktir](#), Ferhat Abbas University, Setif, Algeria

[Prof. Dr. Zahriladha Zakaria](#), Universiti Teknikal Malaysia Melaka, Malaysia

[Prof. Dr. Francis C.M. Lau](#), The University of Hong Kong, Hong Kong

[Assoc. Prof. Dr. Lunchakorn Wuttisittikulkij](#), Chulalongkorn University, Thailand

[Assoc. Prof. Dr. Mochammad Facta](#), Diponegoro University, Indonesia

[Assoc. Prof. Dr. Mohamed Arezki Mellal](#), M'Hamed Bougara University, Algeria

[Asst. Prof. Dr. Supavadee Aramvith](#), Chulalongkorn University, Thailand

[Asst. Prof. Dr. Andrea Francesco Morabito](#), University of Reggio Calabria, Italy

[Dr. Achmad Widodo](#), Universitas Diponegoro, Indonesia

[Dr. Arianna Mencattini](#), University of Rome "Tor Vergata", Italy

[Dr. Deris Stiawan](#), Universitas Sriwijaya, Indonesia

[Dr. Haruna Chiroma](#), Federal College of Education (Technical), Gombe., Nigeria

[Dr. Huchang Liao](#), Sichuan University, China

[Dr. Jacek Stando](#), Technical University of Lodz, Poland

[D. Jude Hemanth](#), Karunya University, India

[Mark S. Hooper](#), Analog/RF IC Design Engineer (Consultant) at Microsemi, United States

[Dr. Munawar A Riyadi](#), Universitas Diponegoro, Indonesia

[Dr. Shahrin Md Ayob](#), Universiti Teknologi Malaysia, Malaysia

[Dr. Surinder Singh](#), SLIET Longowal, India

[Dr. Tutut Herawan](#), Universiti Malaya, Malaysia

[Dr. Yang Han](#), University of Electronic Science and Technology of China, China

[Dr. Yin Liu](#), Symantec Research Labs' Core Research group, United States

[Dr. Youssef Said](#), Tunisie Telecom Sys'Com Lab, National Engineering School of Tunis (ENIT), Tunisia

[Dr. Yutthapong Tuopadung](#), Provincial Electricity Authority (PEA), Thailand

[Dr. Zhixiong Li](#), China University of Mining and Technology, China

USER

 Username

 Password
 Remember me

ICW-TELKOMNIKA

2019 ICW-TELKOMNIKA
 International Conference

JOURNAL METRICS

 SJR 2017 : 0.265
 (Q3)
 CiteScore 2017 : 0.63
 SNIP 2017 : 0.580

 TELKOMNIKA is the best
 journal in Indonesia
 2017

Telkomnika

Q3 Electrical and
 Electronic
 Engineering
 best quartile

SJR 2017
0.26
 powered by scimagojr.com

QUICK LINKS

- Author Guideline
- Editorial Boards
- Reviewers
- Online Submissions
- Abstracting and Indexing
- Publication Ethics
- Visitor Statistics
- Contact Us

JOURNAL HARDCOPY

 Order journal prints
 (hardcopy) << click in
 here>>

JOURNAL CONTENT

 Search

Search Scope

 All

Browse

- By Issue
- By Author
- By Title
- Other Journals

TELKOMNIKA Telecommunication, Computing, Electronics and Control

ISSN: 1693-6930, e-ISSN: 2302-9293

Universitas Ahmad Dahlan, 4th Campus, 9th Floor, LPPI Room

Jl. Ringroad Selatan, Kragilan, Tamanan, Banguntapan, Bantul, Yogyakarta, Indonesia 55191

Phone: +62 (274) 563515, 511830, 379418, 371120 ext. 4902, Fax: +62 274 564604

This work is licensed under a [Creative Commons Attribution-NonCommercial 4.0 International License](https://creativecommons.org/licenses/by-nc/4.0/).**01613104**[View TELKOMNIKA Stats](#)



Scimago Journal & Country Rank Enter Journal Title, ISSN or Publisher Name

- Home
- Journal Rankings
- Country Rankings
- Viz Tools
- Help
- About Us

Telkomnika

13

H Index

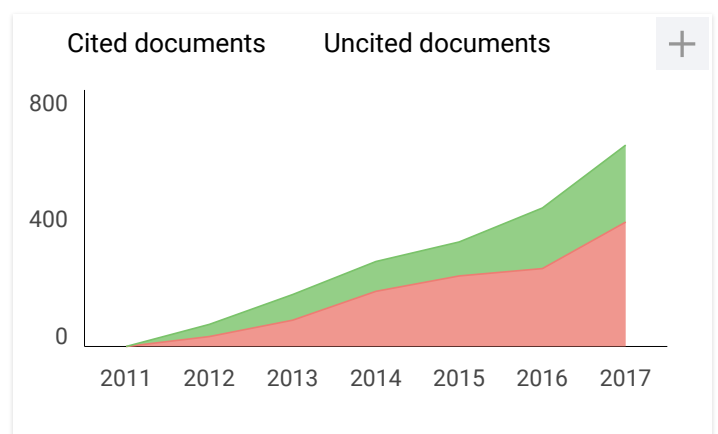
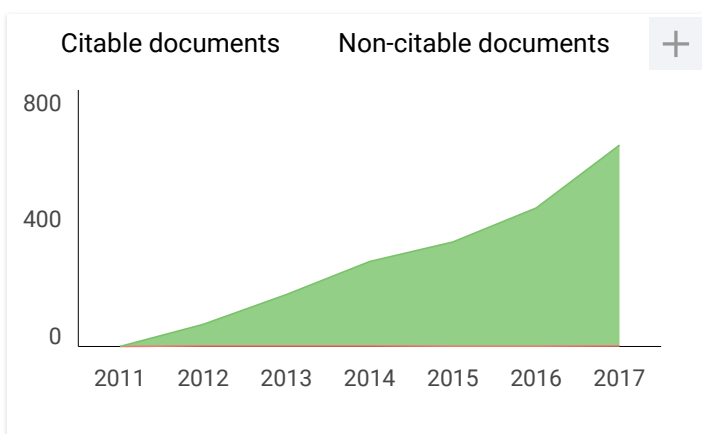
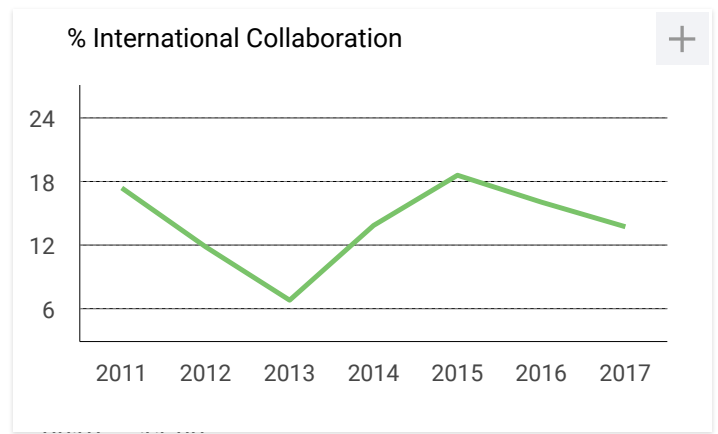
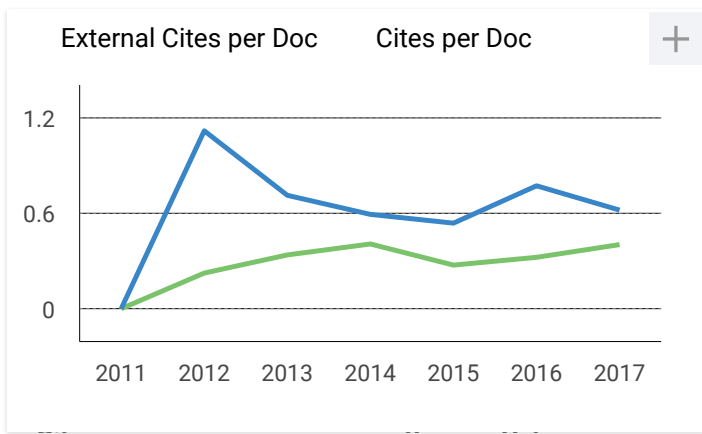
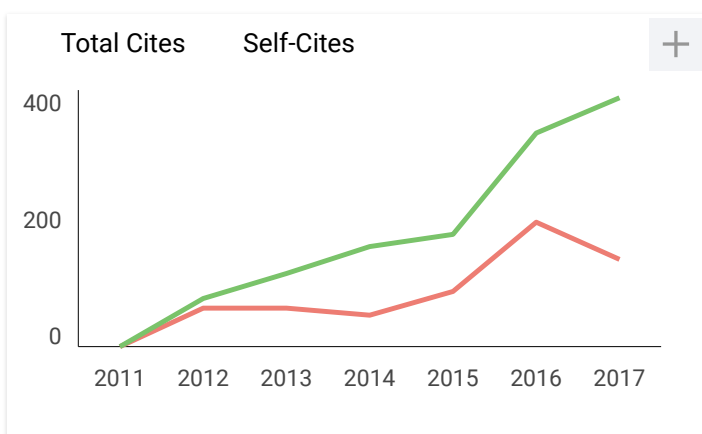
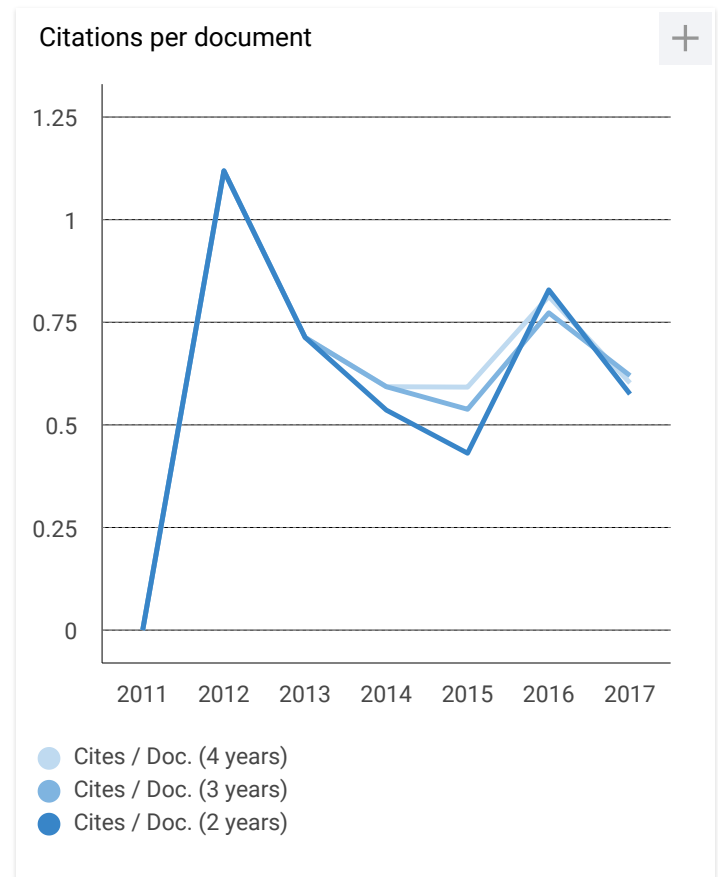
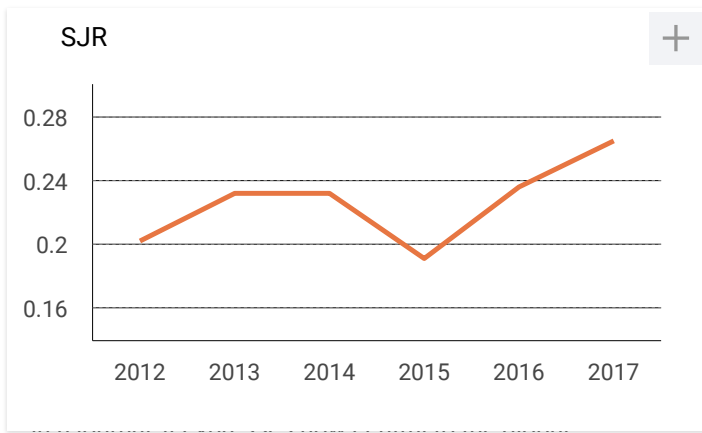
Country	Indonesia - SIR Ranking of Indonesia
Subject Area and Category	Engineering Electrical and Electronic Engineering
Publisher	Institute of Advanced Engineering and Science (IAES)
Publication type	Journals
ISSN	23029293, 16936930
Coverage	2011-ongoing

Scope TELKOMNIKA (Telecommunication, Computing, Electronics and Control) ISSN: 1693-6930, e-ISSN: 2302-9293 is a peer-reviewed, scientific journal published by Universitas Ahmad Dahlan (UAD) in collaboration with Institute of Advanced Engineering and Science (IAES). The aim of this journal is to publish high-quality articles dedicated to all aspects of the latest outstanding developments in the field of electrical engineering. Its scope encompasses the applications of Telecommunication and Information Technology, Applied Computing and Computer, Instrumentation and Control, Electrical (Power), and Electronics Engineering. It was first published in 2003. Beginning with issue 1 of volume 16 (2018), TELKOMNIKA will be published as a bimonthly journal (6 issues/year). The journal registered in the CrossRef system with Digital Object Identifier (DOI) prefix 10.12928. The Journal has been indexed by SCOPUS, Google Scholar, Scholar Metrics etc; accredited 'A' Grade by DGHE (Ministry of Research, Technology and Higher Education, Republic of Indonesia); registered Directory of Open Access Journals (DOAJ), BASE - Bielefeld Academic Search Engine and CORE KMi, etc. The Journal also have a license agreement with ProQuest LLC and EBSCO Publishing.

- [Homepage](#)
- [How to publish in this journal](#)
- [Contact](#)
- [Join the conversation about this journal](#)

Quartiles







← Show this widget in your own website

Just copy the code below and paste within your html code:

```
<a href="https://www.scimagojr.com/journalsearch.php?q=21100256101&tip=sid&clean=0"
```

The widget displays the following information:
- Journal Name: Telkomnika
- Field: Electrical and Electronic Engineering
- Quartile: Q3 (best quartile)
- SJR 2017: 0.26
- Source: powered by scimagojr.com

M

M

R

M

Email

(will not be published)

I'm not a robot

reCAPTCHA
Privacy - Terms

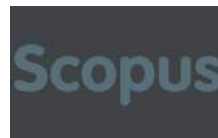
Submit

The users of Scimago Journal & Country Rank have the possibility to dialogue through comments linked to a specific journal. The purpose is to have a forum in which general doubts about the processes of publication in the journal, experiences and other issues derived from the publication of papers are resolved. For topics on particular articles, maintain the dialogue through the usual channels with your editor.

Developed by:



Powered by:



Follow us on @ScimagoJR

Scimago Lab, Copyright 2007-2018. Data Source: Scopus®

EST MODUS IN REBUS
Horatio (Satire 1.1, 106)


TELKOMNIKA

Telecommunication, Computing, Electronics and Control

ISSN: 1693-6930, e-ISSN: 2302-5293

Accredited First Grade by Ministry of Research, Technology and Higher Education, Republic of Indonesia, License No. 216/2017/DT10

 Scopus
indexed

[HOME](#) [ABOUT](#) [LOGIN](#) [REGISTER](#) [SEARCH](#) [CURRENT](#) [ARCHIVES](#)
[ANNOUNCEMENTS](#)
[Home](#) > [Archives](#) > **Vol 17, No 2**

Vol 17, No 2

April 2019

 DOI: <http://dx.doi.org/10.12928/telkomnika.v17i2>

Table of Contents

K-band waveguide T-junction diplexer for satellite communication <i>H. Setti, A. Tribak, A. El Hamichi, J. Zbitou, A. Mediavilla</i>	PDF 549-554
A low-cost fiber based displacement sensor for industrial applications <i>Siti Mahfuza Saimon, Nor Hafizah Ngajikin, Muhammad Shafiq Omar, Mohd Haniff Ibrahim, Muhammad Yusof Mohd Noor, Ahmad Sharmi Abdullah, Mohd Rashidi Salim</i>	PDF 555-560
New design of lightweight authentication protocol in wearable technology <i>Galih Bangun Santosa, Setiyo Budiyo</i>	PDF 561-572
Electrically controlled radiation pattern leaky wave antenna array for (C band) application <i>Mowafak K. Mohsen, M.S.M. Isa, Z. Zakaria, A. A. M. Isa, M. K. Abdulhameed, Mothana L. Attiah, Ahmed M. Dinar</i>	PDF 537-579
Detection of immovable objects on visually impaired people walking aids <i>Abdurrasyid Abdurrasyid, Indrianto Indrianto, Rakhmat Arianto</i>	PDF 580-585
Air pollution monitoring system using LoRa modul as transceiver system <i>Mia Rosmiati, Moch. Fachru Rizal, Fitri Susanti, Gilang Fahreza Alfisyahrin</i>	PDF 586-592
Low-cost communication system for explorer-class underwater remotely operated vehicle <i>Simon Siregar, Muhammad Ikhsan Sani, Muhammad Muchlis Kurnia, Dzikri Hasbiallyoh</i>	PDF 593-600
Remote sensing technology for disaster mitigation and regional infrastructure planning in urban area: a review <i>Muhammad Dimiyati, Akhmad Fauzy, Anggara Setyabawana Putra</i>	PDF 601-608
Information technology investment analysis of hospitality using information economics approach <i>Eva Novianti, Ahmad Nurul Fajar</i>	PDF 609-614
Dashboard settings design in SVARA using user-centred design method <i>Muhammad Yusril Helmi Setyawan, Rolly Maulana Awangga, Rezka Afriyanti</i>	PDF 615-619
Indonesian license plate recognition based on area feature extraction <i>Fitri Damayanti, Sri Herawati, Imamah Imamah, Fifin Ayu M, Aeri Rachmad</i>	PDF 620-627
Facial expression recognition of 3D image using facial action coding system (FACS) <i>Hardianto Wibowo, Fachrunnisa Firdausi, Wildan Suharso, Wahyu Andhyka Kusuma, Dani Harmanto</i>	PDF 628-636
Classification of breast cancer grades using physical parameters and K-nearest neighbor method <i>Anak Agung Ngurah Gunawan, S. Poniman, I Wayan Supardi</i>	PDF 637-644

USER

 Username

 Password
 Remember me

ICW-TELKOMNIKA

2019 ICW-TELKOMNIKA
International Conference

JOURNAL METRICS

 SJR 2017 : 0.265
(Q3)
CiteScore 2017 : 0.63
SNIP 2017 : 0.580

TELKOMNIKA is the best journal in Indonesia 2017

Telkomnika



QUICK LINKS

- Author Guideline
- Editorial Boards
- Reviewers
- Online Submissions
- Abstracting and Indexing
- Publication Ethics
- Visitor Statistics
- Contact Us

JOURNAL HARDCOPY

Order journal prints (hardcopy) << click in here >>

JOURNAL CONTENT

 Search
 Search Scope

Browse

- By Issue
- By Author
- By Title
- Other Journals

<i>Eva Inaiyah Agustin, Riky Tri Yunardi, Aji Akbar Firdaus</i>	965-972	PDF
Face recognition smart cane using haar-like features and eigenfaces <i>Gita Indah Hapsari, Giva Andriana Mutiara, Husein Tarigan</i>	973-980	
Comparative study of 940 nm and 1450 nm near infrared sensor for glucose concentration monitoring <i>Kiki Prawiroredjo, Engelin Shintadewi Julian</i>	981-985	PDF
UDP protocol for multi-task assignment in "void loop" robot soccer <i>Irma Damayanti, Simon Siregar, Muhammad Ikhsan Sani</i>	986-994	PDF
A high efficiency BPSK receiver for short range wireless network <i>Mousa Yousefi, Khalil Monfaredi</i>	995-1005	PDF
State-space averaged modeling and transfer function derivation of DC-DC boost converter for high-brightness LED lighting applications <i>Muhammad Wasif Umar, Norzaihar Yahaya, Zuhairi Baharudin</i>	1006-1013	PDF
Coordination of blade pitch controller and battery energy storage using firefly algorithm for frequency stabilization in wind power systems <i>Teguh Aryo Nugroho, Rahmat Septian Wijanarko, Herlambang Setiadi</i>	1014-1022	PDF
The step construction of penalized spline in electrical power load data <i>Rezy Eko Caraka, Sakhinah Abu Bakar, Gangga Anuraga, M. A. Mauludin, Anwardi Anwardi, Suwito Pomalingo, Vidila Rosalina</i>	1023-1031	PDF
Switchable dual-band bandpass filter based on stepped impedance resonator with U-shaped defected microstrip structure for wireless applications <i>Mussa Mabrok, Zahriladha Zakaria, Yully Erwanti Masrukin, Tole Sutikno, A.R. Othman, Nurhasniza Edward</i>	1032-1039	PDF
Dynamic performance comparison of DFIG and FCWECS during grid faults <i>A. M. Shiddiq Yunus, Makmur Saini, Ahmed Abu-Siada</i>	1040-1046	PDF
Influence of input power in Ar/H ₂ thermal plasma with silicon powder by numerical simulation <i>Yulianta Siregar, Yasunori Tanaka, Yoshihiko Uesugi, Tatsuo Ishijima</i>	1047-1054	PDF
Application of LFAC {16 2/3Hz} for electrical power transmission system: a comparative simulation study <i>Salam Waley Shneen, Mahdi Ali Abdul Hussein, Jaafar Ali Kadhum, Salah Mahdi Ali</i>	1055-1064	PDF
Analysis and investigation of a novel microwave sensor with high Q-factor for liquid characterization <i>Ammar Alhegazi, Zahriladha Zakaria, Noor Azwan Shairi, Tole Sutikno, Rammah A. Alahnomi, Ahmed Ismail Abu-Khadrah</i>	1065-1070	PDF

TELKOMNIKA Telecommunication, Computing, Electronics and Control

ISSN: 1693-6930, e-ISSN: 2302-9293

Universitas Ahmad Dahlan, 4th Campus, 9th Floor, LPPI Room

Jl. Ringroad Selatan, Kragilan, Tamanan, Banguntapan, Bantul, Yogyakarta, Indonesia 55191

Phone: + 62 (274) 563515, 511830, 379418, 371120 ext. 4902, Fax: + 62 274 564604

This work is licensed under a [Creative Commons Attribution-NonCommercial 4.0 International License](https://creativecommons.org/licenses/by-nc/4.0/).**01613108**[View TELKOMNIKA Stats](#)

Fwd: [TELKOMNIKA 2018]: Preparing final camera ready paper for publication on the TELKOMNIKA (a Scopus indexed journal, SJR Q3)

3 messages

----- Forwarded message -----

Dari: **A. M. Shiddiq Yunus, ST, MEngSc, PhD** <shiddiq@poliupg.ac.id>

Date: Jum, 5 Apr 2019 pukul 16.33

Subject: Fwd: [TELKOMNIKA 2018]: Preparing final camera ready paper for publication on the TELKOMNIKA (a Scopus indexed journal, SJR Q3)

To: Makmur Saini <makmur.saini@poliupg.ac.id>

----- Forwarded message -----

Date: Rab, 26 Sep 2018 pukul 00.04

Subject: [TELKOMNIKA 2018]: Preparing final camera ready paper for publication on the TELKOMNIKA (a Scopus indexed journal, SJR Q3)

To: A.M. Shiddiq Yunus Konversi Energi <shiddiq@poliupg.ac.id>

Cc: Assoc. Prof. Dr. Tole Sutikno <tole@journal.uad.ac.id>

Guideline to extend your paper of the TELKOMNIKA to be published on the TELKOMNIKA, a Scopus indexed journal, SJR Q3

****Please pay attention to the details of this email****

#1570463311 entitled "Comparison of Dynamic Performance between DFIG and FCWECS during Grid Fault"

Dear Prof/Dr/Mr/Mrs A. M. Shiddiq Yunus

TELKOMNIKA Telecommunication, Computing, Electronics and Control is a Scopus indexed journal, SJR Q3, and ONLY publishes high quality papers. A high quality paper has:

- (1) a clear statement of the problem the paper is addressing;
- (2) the proposed solution(s); and
- (3) results achieved. It describes clearly what has been done before on the problem, and what is new. The goal of your revised paper is to describe novel technical results.

There are four types of technical results:

1. An algorithm;
2. A system construct: such as hardware design, software system, protocol, etc.; The main goal of your revised paper is to ensure that the next person who designs a system like yours doesn't make the same mistakes and takes advantage of some of your best solutions. So make sure that the hard problems (and their solutions) are discussed and the non-obvious mistakes (and how to avoid them) are discussed.

3. A performance evaluation: obtained through analyses, simulation or measurements;
4. A theory: consisting of a collection of theorems.

Your revised paper should focus on:

1. Describing the results in sufficient details to establish their validity;
2. Identifying the novel aspects of the results, i.e., what new knowledge is reported and what makes it non-obvious;
3. Identifying the significance of the results: what improvements and impact do they suggest.

Second, change title of your paper. The title summarizes the main idea or ideas of your study. A good title contains the fewest possible words needed to adequately describe the content and/or purpose of your research paper. Rarely use abbreviations or acronyms unless they are commonly known. Find the below guide, how to update your paper title.

You have **4 weeks, until October 24, 2018** to revised your paper. Please submit your revised paper by reply this email (telkomnika@journal.uad.ac.id), cc: tole@journal.uad.ac.id. Attach:

1. File Response to Mentor(s) Comments
2. File of your revised paper

When your revised paper reached us, it will be re-checked & reviewed by Editor(s) and Mentor(s) based on your response to Mentor & Coach comments and the following criteria: Relevance, Significance, Novelty, Technical correctness, Experimental/evidential support, Clarity of presentation and Reference to prior work and publications.

I am looking forward to receiving your revised paper.

Your cooperation is very appreciated.

Thank you,

Sincerely yours,

Tole Sutikno, Ph.D.

General Chair, 2018 -TELKOMNIKA

Editor-in-Chief, TELKOMNIKA Telecommunication, Computing, Electronics and Control (Scopus indexed journal, Q3)

email: tole@journal.uad.ac.id

Guideline for preparing your paper title:

A good research paper title: (1) Condenses the paper's content in a few words & Use words that create a positive impression and stimulate reader interest; (2) Captures the readers' attention; (3) Indicate accurately the subject and scope of the study and Differentiates the paper from other papers of the same subject area. Five (5) Simple steps to write a good research paper title:

STEP 1: Ask yourself these questions and make note of the answers:

What is my paper about?

What techniques/ designs were used?

Who/what is studied?

What were the results?

STEP 2: Use your answers to list key words.

STEP 3: Create a sentence that includes the key words you listed

STEP 4: Delete all unnecessary/ repetitive words and link the remaining.

STEP 5: Delete non-essential information and reword the title.

Mentor & Coach Comments:

General Guidelines:

1. Please re-read our instructions (at: <http://journal.uad.ac.id/index.php/TELKOMNIKA/about/editorialPolicies#custom-1>) carefully and follow the checklist strictly, as any spelling mistakes and errors may be translated into the typeset version.
2. The “result and discussion” section reports the most important findings, including analysing results as appropriate. It is very important to prove that your manuscript has a significant value and not trivial.
3. Please re-check that all references are already cited in your article, and order of your citation is SEQUENTIAL

example in a paper:

—> [1-4], [2], [5-6], [7-9], [8], [4-5], [9], [10-14], [12], [15] (SEQUENTIAL) — correct

—> [1], [2], [3], [4-6], [7], [8-10], [4-5], [11-16], [13], [17] (SEQUENTIAL) — correct

—> [2], [3], [6], [1], [4-5], [7], [11-16], [8-10], [13], [17] (NOT SEQUENTIAL) — INCORRECT

—> [4-5], [7], [2], [3], [17], [6], [1], [11-16], [8-10], [13] (NOT SEQUENTIAL) — INCORRECT

4. If your need references to improve your paper, please get take a look at:

- <http://iaescore.com/journals/index.php/ijece>
- <http://iaescore.com/journals/index.php/ijeecs>
- <http://iaescore.com/journals/index.php/ijpeds>
- <http://journal.uad.ac.id/index.php/TELKOMNIKA>
- <http://journal.portalgaruda.org/index.php/EEI>


Please use “Search” at menu "Journal Content" in right side of the site.

--

A. M. Shiddiq Yunus, S.T., M.Eng.Sci., Ph.D.

=====
Energy Conversion Study Program,
Mechanical Engineering Department,
State Polytechnic of Ujung Pandang


Center for Renewable Energy and Smart Grid Application
=====

 **1570463311 Comment.docx**
18K

Makmur Saini <makmur.saini@fkegraduate.utm.my>
To: Makmur Saini <makmur.saini@poliupg.ac.id>

Fri, Apr 5, 2019 at 6:55 PM


[Quoted text hidden]

 **1570463311 Comment.docx**
18K

From: **Makmur Saini** <makmur.saini@poliupg.ac.id>
Date: Fri, Apr 5, 2019 at 6:52 PM

[Quoted text hidden]

[Quoted text hidden]

 **1570463311 Comment.docx**
18K

Dynamic performance comparison of DFIG and FCWECS during grid faults

A. M. Shiddiq Yunus*¹, Makmur Saini², Ahmed Abu-Siada³

^{1,2}Politeknik Negeri Ujung Pandang, Jalan PerintisKemerdekaan Km. 10 Makassar, Indonesia

³Curtin University, Kent Street, Bentley WA, Australia

*Corresponding author, e-mail: shiddiq@poliupg.ac.id¹, makmur.saini@poliupg.ac.id², a.abusiada@curtin.edu.au³

Abstract

Among several types, variable speed-based wind turbine generator (WTG) is the most popular type installed worldwide. This type of WTG is able to extract 5% more energy from wind speed compared to the fixed speed WTG. There are two kinds of variable speed based WTG; Doubly Fed Induction Generator (DFIG) and Full Converter Wind Energy Conversion System (FCWECS). DFIG and FCWECS are placed at the first and second topWTG installation worldwide since 2004. However, both of them are very sensitive to the grid dip fault and may violate the allowable margins identified by various international Fault Ride Through (FRT) codes. This paper aims to investigate the responses of DFIG and FCWECS during certain level of grid dips and compare their performance under such event. Results show some differences of the performance of DFIG and FCWECS during voltage sag event, however the voltage profile at the point of common coupling is much better in case of DFIG. Results also recommend that DFIG can be effective when connected to weak grids whilst FCWECS is preferably to be connected to strong grids.

Keywords: DFIG; FCWECS; FRT; voltage dip and wind

Copyright © 2019 Universitas Ahmad Dahlan. All rights reserved.

1. Introduction

Due to the catastrophic impacts of conventional based power plants, many countries are now more concern on renewable based power plants. Among the renewable based power plants, wind turbine generator (WTG) is relatively popular due to the rapid increase of power electronics development that can be equipped to WTG. According to the report of JRC, the total number of WTG installed worldwide is about 430 GW in 2015 [1]. In this report, Doubly Fed Induction generator (DFIG) dominated about 54% installation, brings it into the top installed WTG worldwide and followed in the second position by Full Converter Wind Energy Conversion System (FCWECS) that installed about 17.5% for both onshore and offshore. Although both DFIG and FCWECS are capable in extracting more energy about 5% compare to the fixed speed [2-4], both of them are very sensitive with grid fault such as voltage dip [5, 6]. When severe fault occurs at the grid side, voltage profile at point of common coupling (PCC) may violate the international grid codes including fault ride through (FRT) such as FRT of Spain. Therefore it is necessarily important to investigate the system with DFIG and FCWECS whether they comply the fault ride through (FRT) or not. If voltage at PCC violates the FRT, the WTG should be disconnected from the grid to avoid any damages on the WTG. One of the International FRTs is FRT Spain as illustrated in Figure 1 [7].

Area "A" shows the maximum allowed voltage rise in FRT Spain with maximum 130% that allowed for 0.5s and furthermore it maximum margin drops to 120% and lasting for 1.0s. A normal margin is shown within area "B". Approximately 10% above or less than the normal rate (100%) is still classified as in normal condition. Area "C" indicates the lower voltage drop that allowed in FRT Spain. When voltage drop hit beyond the allowed margin as shown in area "C", the WTG must be disconnected soon from the grid. There are many papers discussed about DFIG and FCWECS as discussed in [8-18] however, no attention are given for head-to-head performances comparison between them when faults are applied in the same type and magnitude particularly when both of WTGs should comply the grid code.

This paper highlights the comparison of dynamics performances between two types of variable speed based WTG. These two types; DFIG and FCWECS placed in the top first and second position in their popularity in worldwide installation. The comparison can give the related authority to determine the most appropriate selection between the two for their needs according to these two types based on their capability in comply the grid codes during voltage dip events. To validate the results, two cases of different levels of sag were applied using extension simulation with Simulink/Matlab where the systems for both models are built.

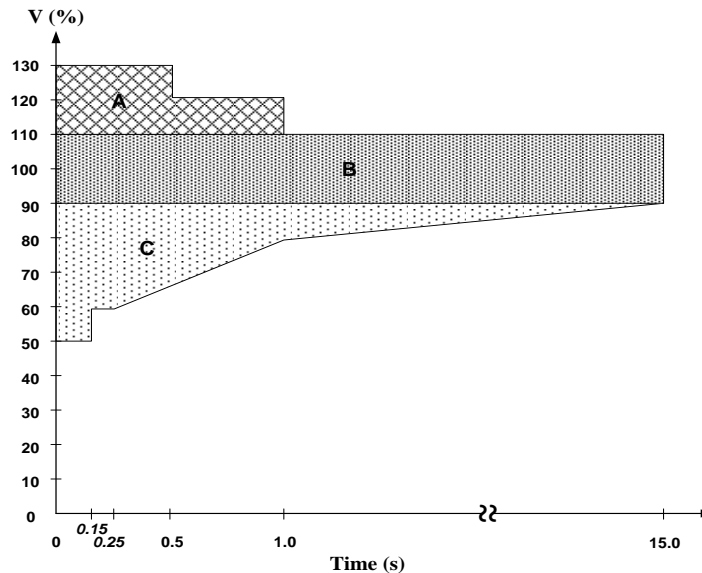


Figure 1. FRT of Spain grid code [7]

2. System Under Study

2.1. Doubly Fed Induction Generator (DFIG)

An DFIG system consists of two converters that are called Grid Side Converter (GSC) and Rotor Side Converter (RSC) which is linked with a capacitor to allow transfer of some amount of energy from/to the grid [19-23]. It is much popular compare to the FCWECS as an DFIG has about one third power electronics capacity which in turn reduced the total cost of an DFIG significantly compared to a FCWECS. The generic model of a DFIG can be seen in Figure 2. Slip rings make the electrical connection to the rotor. If the generator is running super-synchronously, the electrical power is transferred to the grid through both the rotor and the stator. Meanwhile, electrical power is delivered into the rotor from the grid, if the generator is running sub- synchronously. A speed variation of $\pm 30\%$ around synchronous speed can be obtained by the use of a power converter of 30% of nominal power. Furthermore, it is possible to control both active (P_{ref}) and reactive power (Q_{ref}), which gives a better grid performance and the power electronics enables the wind turbine to act as a more dynamic power source to the grid. Parameters of DFIG converters are provided in Table 1. Typical configuration of a DFIG and its Matlab/Simulink model can be seen in Figure 2(a) and (b) respectively.

2.2. Full Converter Wind Energy Conversion System (FCWECS)

The counterpart variable speed of DFIG is FCWECS. Using PMSG or WRSG, it allows reducing the cost by considering applying many poles generators for slow generator speed. Therefore, the generic typical model of a FCWECS as shown in Figure 3(a) giving an option to use or not a gearbox depends on the type of selected generator. A FCWECS using full converter that placed between generator and the grid side. A capacitor is used as DC link to adapt voltage fluctuate due the natural intermittent of wind speed [24, 25]. With 100% capacity of converters employed in FCWECS the cost should also be increased. The Matlab/Simulink model of the studied FCWECS is shown in Figure 3(b).

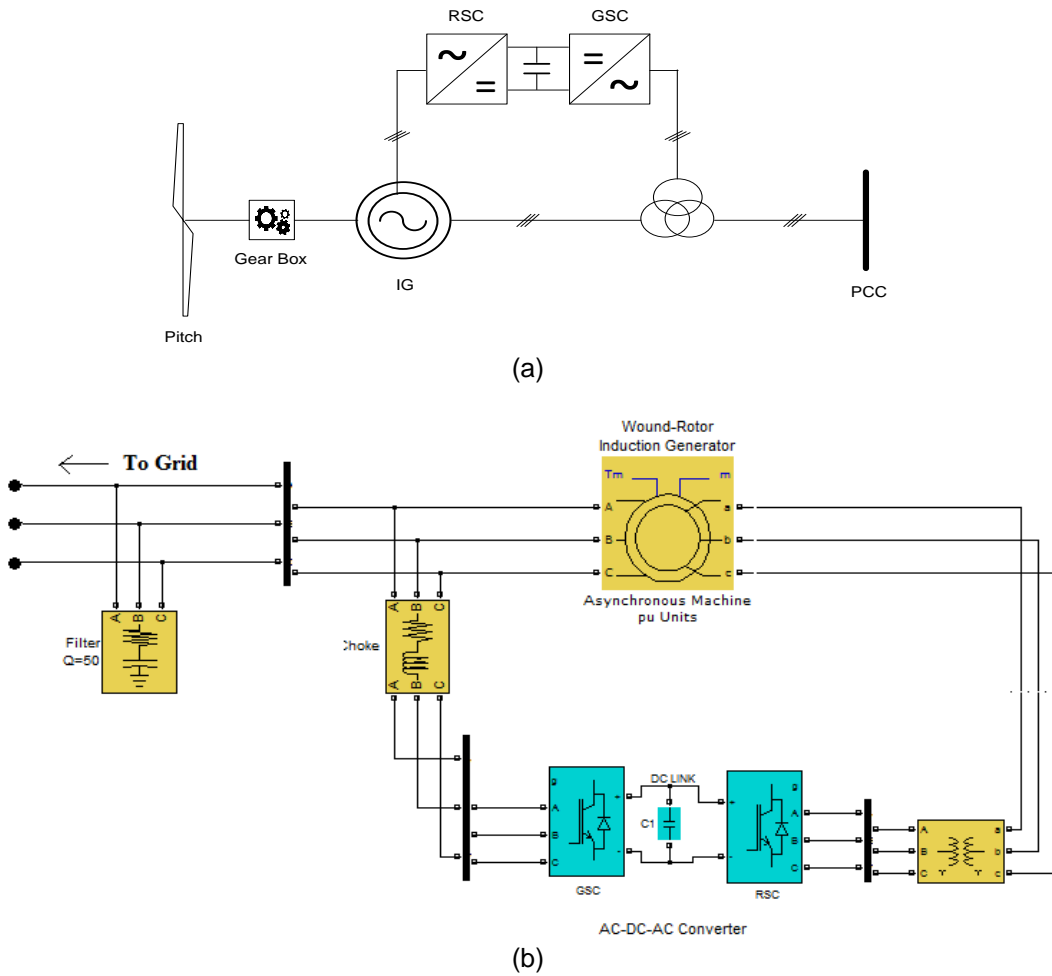


Figure 2. (a) Typical generic model of a DFIG with partial power converters and (b) Matlab/Simulink Model for DFIG

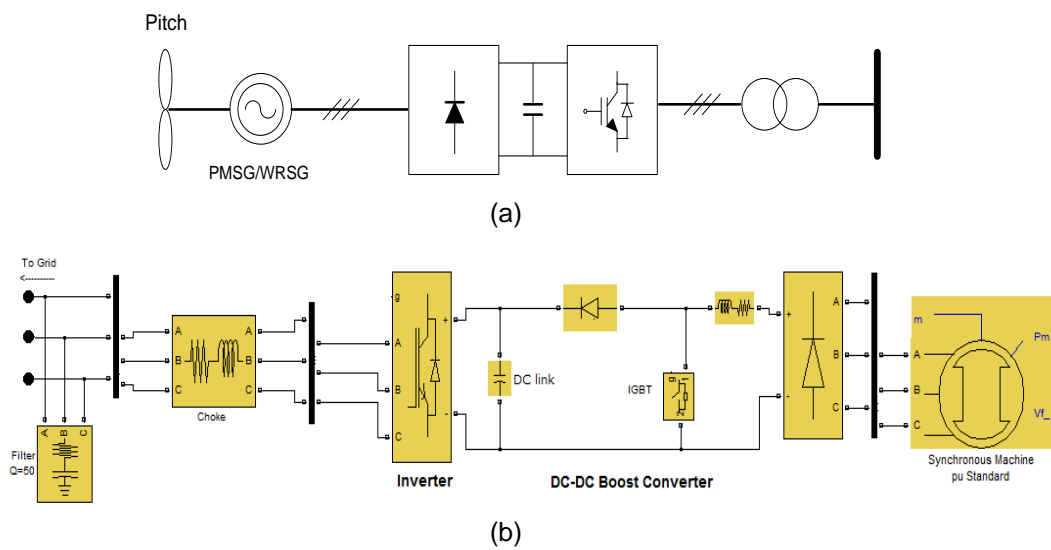


Figure 3. (a) Typical generic model of a FCWECS with full converter and (b) Matlab/Simulink Model for FCWECS

The FCWECS configuration that is shown in Figure 3 consists of two converters: machine side converter (MSC) and grid side converter (GSC). MSC operates as a driver that is controlling the generator torque, whilst GSC will control the amount of active and reactive power to be transferred to the grid. Capacitor is used as a storage device that will store the captured wind energy and might instantaneously be transferred to the grid. In this configuration, the voltage across the DC link capacitor will be maintained constant. Parameters of FCWECS converters are provided in Table 1.

Table 1 Parameters of Both WTG Converters

Parameters	DFIG	FCWECS
Grid side coupling inductor (L, R) (pu)	0.3, 0.003	0.15, 0.003
Nominal DC bus Voltage (V)	1150	1100
DC bus Capacitor (F)	0.01	0.09

2.3. System under Study

As can be seen in Figure 4, system under study consists of 5x1.5 MW DFIG/FCWECS. The WTGs is connected through a step-up transformer and a 30 Km distribution line. Before connected to the grid, a step-up transformer is used to match the grid voltage 120 kV. All models used in this study are developed and carried out using Matlab/SIMULINK. The main parameters used for the system under study including DFIG and FCWECS are provided in Tables 2 and 3 [3].

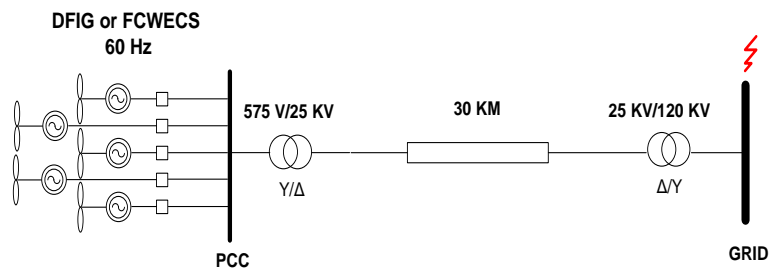


Figure 4. System under study

Table 2. Parameters of Distribution Line

Parameters	Distribution line
R_1 (ohms/km)	0.1153
R_0 (ohms/km)	0.413
L_1 (H/km)	1.05e-3
L_0 (H/km)	3.32e-3
C_1 (F/km)	11.33e-9
C_0 (F/km)	5.01e-9

Table 3. Parameters of DFIG and FCWECS Model

Parameters	DFIG	FCWECS
Rated Power	5 x 1.5 MW	5 x 1.5 MW
R_s (p.u.)	0.023	0.006
$H(s)$ (p.u.)*	0.685	0.62
V_{dc} (V)	1150	1100

3. Results and Discussion

There are two magnitude level of grid dip applied in this study; voltage dip of 0.5 p.u. (case I) and 0.3 p.u. (case II) Both cases are assumed to be last for 0.05s (around 3 cycles). The simulation results for case I and case II are plotted in Figure 5 and Figure 6 respectively.

3.1. Case I

As can be seen in Figure 5(a), during the grid dip, generated power of DFIG is drop significantly to 0.4 p.u. moreover, when fault is cleared out at 0.55s, generator tends to generate more power before quickly return to normal. Meanwhile, generated power of FCWECS is drop slightly below the DFIG's response. However, when fault is cleared out, FCWECS experiencing a better self-healing to return quickly to the steady state position.

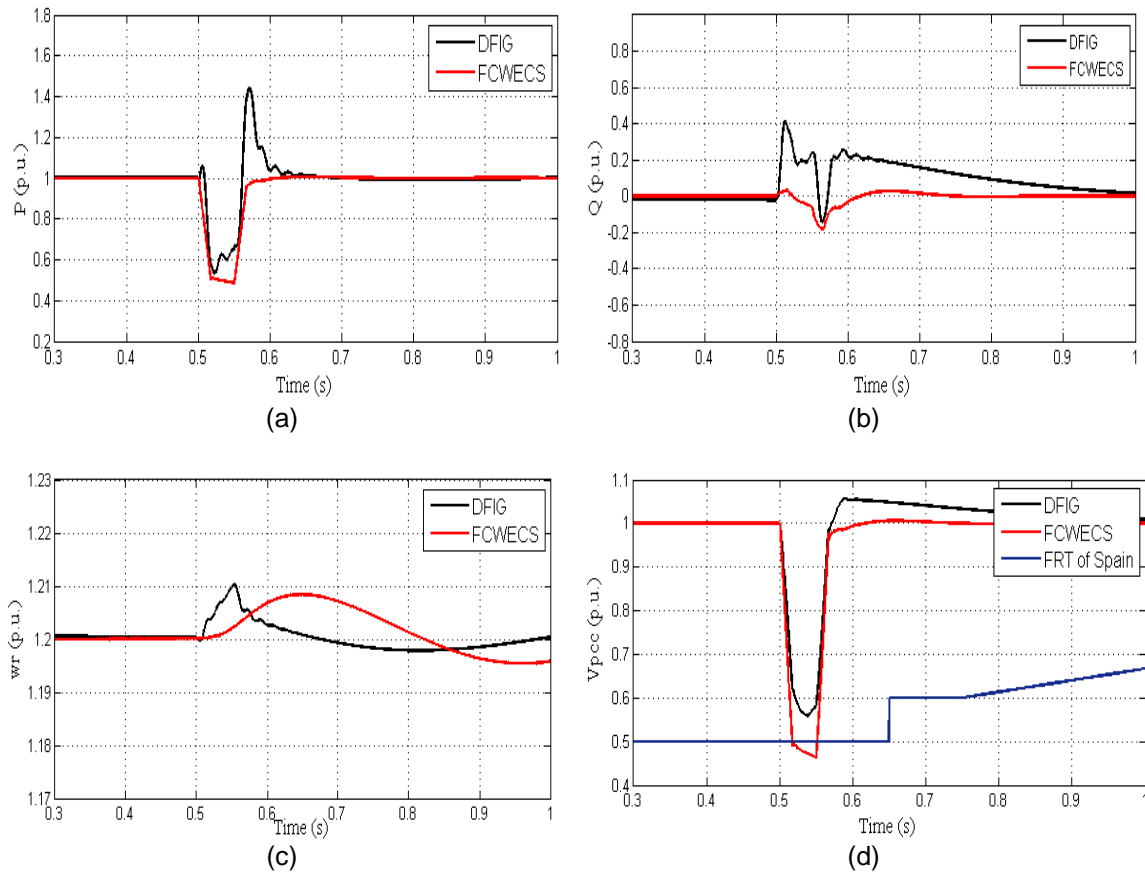


Figure 5. Responses of both DFIG and FCWECS during grid voltage dip of 0.5 p.u. (a) Generated Power; (b) Reactive Power; (c) Generator Speed (ω_r); and (d) Voltage Profile at PCC

Reactive power produced by DFIG is also larger than FCWECS as shown in Figure 5(b). Meanwhile both DFIG and FCWECS experiencing oscillate ω_r during grid dip of 0.5 p.u. (Figure 5(c)). The main indicator for FRT in grid codes is voltage profile at PCC as it is the one who determined whether the WTG can be remain connected to the grid or not. As plotted in Figure 5(d), voltage drop at PCC for FCWECS drops below the minimum voltage that allowed in FRT of Spain as described in Figure 1, meaning that the FCWECS type should be disconnected from the grid to avoid any damages on WTG. However, for DFIG, voltage drop at PCC is still within the safety margin of FRT Spain, therefore in this case, DFIG is remaining safe to be connected with the grid.

3.2. Case II

Severer case is applied in case II where the magnitude of voltage dip is set to 0.3 p.u. Similar trend to case I, generated active power is drop almost 75% for both DFIG and FCWECS, however, FCWECS experiencing better response when the grid dip is cleared out as can be seen in Figure 6(a). Figure 6(b) shows that reactive power is delivery more by DFIG compared to FCWECS with higher amount compare to case I. Similar to case I, FCWECS experiencing larger oscillation of ω_r and required more time to get into steady state compare to DFIG as depicted in Figure 6(c). As the magnitude of voltage dip is larger than in case I, the voltage drop for both DFIG and FCWECS hit and violate the minimum allowable voltage drop by FRT Spain, therefore in such case, both DFIG and FCWECS should be disconnected from the grid.

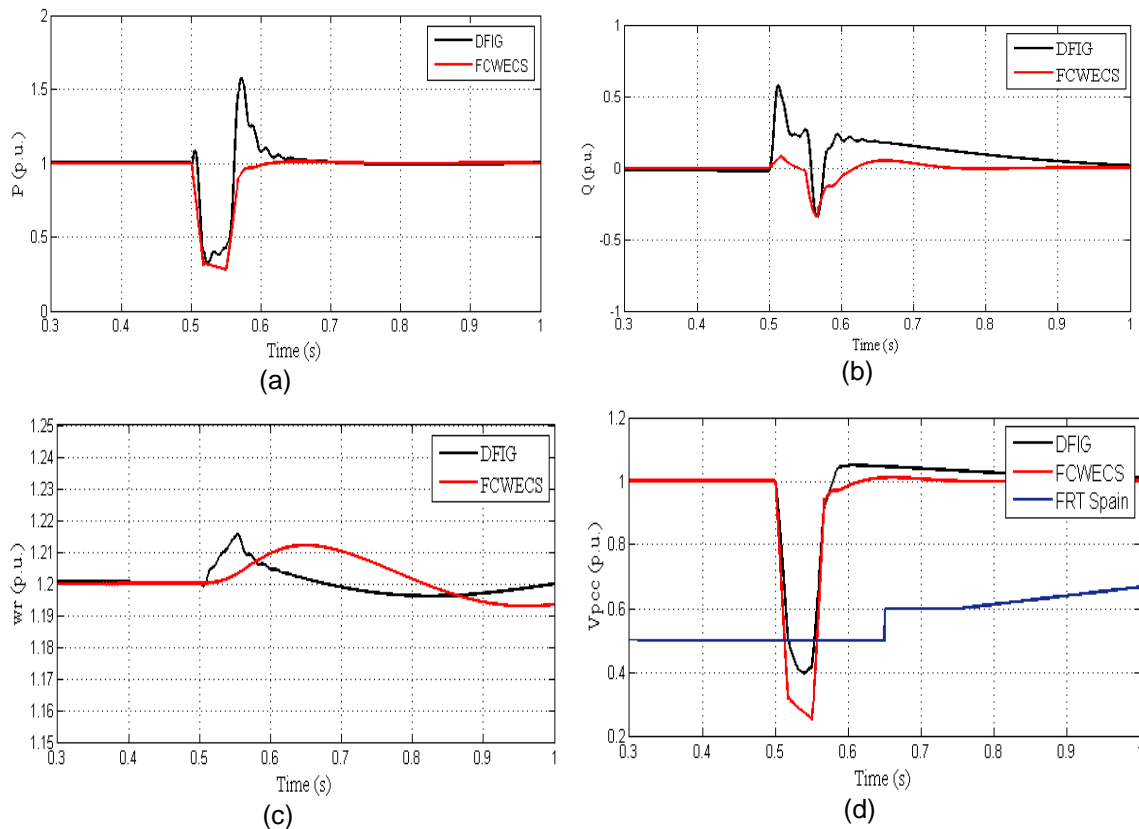


Figure 6. Responses of both DFIG and FCWECS during grid voltage dip of 0.3 p.u. (a) Generated Power; (b) Reactive Power; (c) Generator Speed (ω_r); and (d) Voltage Profile at PCC.

4. Conclusion

In this paper, performance comparison of the DFIG and FCWECS under voltage sag events is presented. Results show that, performance of FCWECS is better in terms of the generated active and reactive power and also the generator shaft speed oscillation. However, DFIG shows a better performance in terms of the voltage profile at the point of common coupling particularly when complying with the low voltage FRT of Spain. In case of significant voltage dip event, both DFIG and FCWECS can not be remained connected to the grid in order to avoid any damages to the WTGs. These results can help in selecting the suitable WTG type based on the grid requirement and operating conditions. If the grid is stiffer, FCWECS could become an option. However, for weak grids, a DFIG might be a better option to connect with.

Acknowledgment

Author would like to thank Center of Sustainable Energy and Smart Grid Applications (CoSESGA) and Politeknik Negeri Ujung Pandang for supporting the research and funding for attending the conference.

References

- [1] C Vázquez Hernández, T Telsnig, A Villalba Pradas, C Vazquez Hernandez, T Telsnig, A Villalba Pradas. JRC Wind Energy Status Report 2016 Edition. 2017.
- [2] J M Carrasco *et al.* Power-Electronic Systems for the Grid Integration of Renewable Energy Sources: A Survey. *Ieee Trans. Ind. Electron.* 2006; 53(4): 1002–1016.
- [3] AMS Yunus, A Abu-Siada, MAS. Masoum, Improvement of LVRT capability of variable speed wind turbine generators using SMES unit, Innovative Smart Grid Technologies Asia (ISGT), 2011 IEEE PES. 2011: 1-7.

- [4] T Benamimour, A Bentounsi, H Djeghloud. Study of Wind Turbine based Variable Reluctance Generator using Hybrid FEMM-MATLAB Modeling. *International Journal of Electrical and Computer Engineering*. 2017; 7(1): 1-11.
- [5] J Lopez, E Gubia, E Olea, J Ruiz, L Marroyo. Ride Through of Wind Turbines With Doubly Fed Induction Generator Under Symmetrical Voltage Dips, *IEEE Trans. Ind. Electron.*, 2009; 56(10): 4246–4254.
- [6] A Hamzeh, Sadeq A. Hamed, Zakaria Al-Omari. Wind Generation Impact on Symmetrical Fault Level at Grid Buses. *International Journal of Electrical and Computer Engineering*. 2018; 8(5): 2682-2690.
- [7] M Altin, Ö Göksu, R Teodorescu, P Rodriguez, BB Jensen, L Helle. Overview of recent grid codes for wind power integration. *Proc. Int. Conf. Optim. Electr. Electron. Equipment, OPTIM*, 1152–1160, 2010.
- [8] AM Shiddiq Yunus, A Abu-Siada, MAS Masoum. Improving dynamic performance of wind energy conversion systems using fuzzy-based hysteresis current-controlled superconducting magnetic energy storage. *IET Power Electron.*, 2012; 5(8): 1305-1314.
- [9] AMS Yunus, A Abu-Siada, MAS Masoum. Effects of SMES on dynamic behaviors of type D-Wind Turbine Generator-Grid connected during short circuit. *IEEE Power Energy Soc. Gen. Meet.* 2011: 11–16.
- [10] AMS Yunus, A Abu-Siada, MAS Masoum. Effect of SMES unit on the performance of type- 4 wind turbine generator during voltage sag. in *IET Conference on Renewable Power Generation (RPG 2011)*, 2011: 6–9.
- [11] Helmy Mohammed EI_Zoghby, SM Sharaf. Dynamic Response of a Grid Connected Wind Farm with Different Types of Generators. *International Journal of Power Electronics and Drive System (IJPEDS)*. 2012; 2(1): 85-98.
- [12] Naim Cherfia, Djallel Kerdoun. Wind Energy Conversion Systems Based On a DFIG Controlled By Indirect Vector Using PWM and SVM. *International Journal of Electrical and Computer Engineering (JECE)*, 2016; 6(2): 549–559.
- [13] G Venu Madhav, YP Obulesu. A Fuzzy Logic Control Strategy for Doubly Fed Induction Generator for Improved Performance under Faulty Operating Conditions. *International Journal of Power Electronics and Drive System (IJPEDS)*. 2014; 4(4): 419–429.
- [14] M Jannati, S Eskandari, T Sutikno. Speed Control of 3-phase Induction Motors under Fault Conditions Supplied by Wind Turbine Using Indirect Vector Control. *International Journal of Power Electronics and Drive System (IJPEDS)*. 2017; 8(1): 222-230.
- [15] A Zare, A Forouzantabar. Adaptive Robust Control of Variable Speed Wind Turbine Generator. *Bulletin of Electrical Engineering and Informatics* 2015; 4(3): 196-203.
- [16] R Arindya. A Variable Speed Wind Generation System Based on Doubly Fed Induction Generator. *Bulletin of Electrical Engineering and Informatics*, 2013; 2(4): 272-277.
- [17] A Kavitha, AV Suresh. A Novel Inter Connection of DFIG with Grid in Separate Excitation SMES System with Fuzzy Logic Control. *Bulletin of Electrical Engineering and Informatics*. 2015;4(1): 43-52.
- [18] MR Djalal, A Imran, H. Setiadi. Optimal Frequency Control System on Wind-Diesel Hybrid Generator with Imperialist Competitive Algorithm. *Jurnal Teknologi dan Sistem Komputer*. 2017; 5(4): 135-141.
- [19] Saher A, Muwaffaq I, Alomoush Ahmed MK.Gravitational-Search for Optimal Controller Design of Doubly-fed Induction Generator. *International Journal of Electrical and Computer Engineering (JECE)*. 2018; 8(2): 780-792.
- [20] Naim C, Djallel K. Wind Energy Conversion Systems Based on a DFIG Controlled By Indirect Vector Using PWM and SVM. *International Journal of Electrical and Computer Engineering (JECE)*. 2016; 6(2): 549-559.
- [21] MY Khamaira, AMS Yunus, A Abu-Siada. Improvement of DFIG-based WECS performance using SMES unit. *Power Engineering Conference (AUPEC)*, 2013 Australasian Universities, 1-5. 2013.
- [22] A Boulahia, M Adel, H Benalla. Predictive Power Control of Grid and Rotor Side converters in Doubly Fed Induction Generators Based Wind Turbine. *Bulletin of Electrical Engineering and Informatics*. 2013; 2(4): 258-264.
- [23] Ahmed AS, Farhad S, Yasser AH, AMS Yunus. Application of Flexible AC Transmission System Devices in Wind Energy Conversion Systems. Bentham Science Publishers. 2017.
- [24] Youness El Mourabit, et all. DTC-SVM Control for Permanent Magnet Synchronous Generator based Variable Speed Wind Turbine. *International Journal of Power Electronics and Drive System (IJPEDS)*. 2017; 8(4): 1732–1743.
- [25] B Bechir, B Faouzy, M Gasmi.Wind Energy Conversion System with Full-Scale Power Converter and Squirrel Cage Induction Generator. *International Journal of Physical Sciences*. 2012; 7(46): 6093-6104.