YAYASAN BRATA BHAKTI DAERAH JAWA TIMUR
UNIVERSITAS BHAYANGKARA SURABAYA
LEMBAGA PENELITIAN DAN PENGABDIAN PADA MASYARAKAT
(LPPM)
Kampus : Jl. A. Yani 114 Surabaya Telp. 031 - 8285602, 8291055, Fax. 031 - 8285601

SURAT KETERANGAN

Nomor: Sket/ 10 /I/2023/LPPM/UBHARA

Kepala Lembaga Penelitian dan Pengabdian kepada Masyarakat (LPPM) Universitas Bhayangkara Surabaya menerangkan bahwa:

Nama : Dr. Amirullah, ST, MT.
NIP : 197705202005011001
NIDN : 0020057701
Unit Kerja : Universitas Bhayangkara Surabaya

Benar telah melakukan kegiatan:

1. Menulis jurnal berjudul Power Quality Analysis of Integration Photovoltaic Generator to Three Phase Grid under Variable Solar Irradiance Level (Amirullah, Ontoseno Penangsang, dan Adi Soeprijanto) yang telah dipublikasikan di TELKOMNIKA Vol.14, No.1, March 2016, pp. 29~38, ISSN: 1693-6930, Publisher: Universitas Ahmad Dahlan (UAD) in collaboration with Institute of Advanced Engineering and Science (IAES) **Terindeks Scopus Q3.**
2. Telah melakukan korespondensi melalui email dalam proses penerbitan jurnal tersebut. Bukti korespondensi email dan bukti pendukung adalah benar sudah dilakukan oleh yang bersangkutan serta sudah dilampirkan bersama surat ini.

Demikian surat keterangan ini dibuat untuk kepentingan kelengkapan pengusulan Guru Besar.

Surabaya, 20 Januari 2023
Kepala LPPM

Drs. Heru Irianto, M.Si.
NIP. 9000028

Lampiran 1

Bukti Korespondensi Email dengan Editor/Pengelola Jurnal

Re: Cara upload makalah CEIE 2015

From: amir rullah (am9520012003@yahoo.com)

To: ceie2015@um.ac.id

Cc: ceie2015@um.ac.id

Date: Tuesday, 25 August 2015 at 02:35 pm GMT+7

Bersama ini saya kirimkan makalah lengkap untuk dimuat di seminar CIEI 2015 di UM Malang berjudul:

No urut uploaded paper 68: "Power Quality Analysis of Integration Photovoltaic Generator to Three Phase Grid **under** Variable Solar Irradiance Level"

Kata **in** dalam judul makalah yang dikirim sebelumnya mohon diganti menjadi **under** (Bahasa-Inggrisnya lebih pas)

Untuk sementara nanti koreksinya lebih ke arah substansi (isi), untuk format (2 kolom) akan disesuaikan jika makalah sudah diterima (accepted) pada 30 Agustus 2015. Saya sengaja memasukkan makalah lengkap supaya panitia (reviewer) bisa tahu lebih detail tentang pembahasan makalah selain dari abstak.

Demikian atas perhatiannya disampaikan terima-kasih.

Hormat: Amirullah
Pemakalah CEIE 2015
Mahasiswa S3 ITS Surabaya (Power System)

> On Thursday, 20 August 2015, 23:59, amir rullah <am9520012003@yahoo.com> wrote:
>
> Bersama ini saya kirimkan makalah untuk dimuat di seminar CIEI 2015 di UM Malang berjudul:
>
> **Power Quality Analysis of Integration Photovoltaic Generator to Three Phase Grid in Variable Solar Irradiance Level**
>
> Saya sudah mencoba akses web ceie 2015 untuk upload makalah secara online namun ternyata jaringan terputus (error), sehingga saya minta tolong mas/mbak admin untuk uploadkan makalah ini. Untuk sementara nanti koreksinya lebih ke arah substansi (isi), untuk format (2 kolom) akan disesuaikan jika makalah ini diterima karena mengejar deadline malam ini 20 Agustus 2015. Saya sengaja memasukkan makalah lengkap supaya panitia bisa tahu lebih detail tentang pembahasan makalah.
>
> Demikian atas perhatian dan bantuannya disampaikan terima-kasih.
>
> Amirullah-Ubhara Surabaya
> Mhs S3 TE-ITS Surabaya (Power System)

On Thursday, 20 August 2015, 20:27, amir rullah <am9520012003@yahoo.com> wrote:

Sudah bisa login, saya sedang edit materi makalah 1 or 2 jam lagi rencana saya upload paper.

Amirullah-Ubhara Surabaya

On Thursday, 20 August 2015, 20:24, ceie 2015 <ceie2015@um.ac.id> wrote:

Dear amir,
Silahkan attach file lewat email, kami besok akan membantu submit abstract anda, mohon maaf jika UI masih membuat bingung, terima kasih,
On Aug 20, 2015 8:21 PM, "amir rullah" <am9520012003@yahoo.com> wrote:

> Saya mau kirim makalah ke CEIE 2015 sudah registrasi dan sudah konfirmasi tapi ketika login untuk masukkan alamat email dan password lagi (yang sudah dikonformasi tadi) ternyata tidak bisa (tertulis alamat email dan password incorrect). Mohon petunjuk bagaimana caranya supaya saya bisa upload segera karena hari ini terakhir upload makalah CEIE 2015.
>
> Amirullah
> Ubhara Surabaya
> Mhs S3 TE-ITS Surabaya
> 081-949649423

Amirullah_English Jurnal Seminar CEIE UM Malang 2015_Oke.pdf
905.4kB

Re: Kapan pengumuman hasil review abstrak CEIE 2015

From: ceie 2015 (ceie2015@um.ac.id)

To: am9520012003@yahoo.com

Date: Wednesday, 2 September 2015 at 07:21 am GMT+7

Dear Amirullah

Best regards,
CEIE 2015 Committee
Department of Electrical Engineering,
State University of Malang

2015-09-01 15:34 GMT+07:00 amir rullah <am9520012003@yahoo.com>:

> Sesuai email sebelumnya pengumuman penerimaan makalah CEIE 2015 di UM Malang ditunda sampai 31 Agustus 2015 dari waktu seharusnya 30 Agustus 2015. Saya cek di menu online sampai sekarang pengumuman masih belum keluar (still under review). Kapan waktu pengumuman sebenarnya or yang pasti?
>
> Demikian untuk menjadi maklum.
>
> Hormat: Amirullah
> Mahasiswa S3 ITS
> Calon Pemakalah Nomor 68

On Sunday, 30 August 2015, 18:51, ceie 2015 <ceie2015@um.ac.id> wrote:

Dear Mr. Amir rullah, besok kami akan mengirim email pengumumannya

Best regards,
CEIE 2015 Committee
Department of Electrical Engineering,
State University of Malang

2015-08-30 9:27 GMT+07:00 amir rullah <am9520012003@yahoo.com>:

> Hari ini adalah jadwal pengumuman hasil review abstrak CEIE 2015. Saya cek di menu online pengumuman tsb masih belum keluar. Kapan pengumuman tsb keluar? Apa ada penundaan waktu kembali?
>
> Demikian atas jawabannya disampaikan terima-kasih.
>
> Hormat: Amirullah
> Calon Pemakalah CEIE 2015
> Nomor Urut 68

Announcement | CEIE 2015 | State University of Malang

From: ceie 2015 (ceie2015@um.ac.id)

To: am9520012003@yahoo.com

Date: Wednesday, 2 September 2015 at 07:54 pm GMT+7

Dear Amirullah,

It is a great pleasure to inform you that CEIE 2015 Committee organized by State University of Malang after peer reviewed by International Experts in the area has decided to ACCEPT your paper entitled "**Power Quality Analysis of Integration Photovoltaic Generator to Three Phase Grid in Variable Solar Irradiance Level**" ID Number **B-21** for presentation. Here we attached your paper review, and please submit your paper correction (abstract + full paper) before 20th September 2015.

Here we attached some documents to complete the registration. Click the following link to submit your full paper :http://elekro.um.ac.id/ceie/2015/member/

Please visit our website at elektro.um.ac.id/ceie/2015 (for registration and payment), or contact us at ceie2015@gmail.com

Sincerely yours,

Dr. Eng. Siti Sendari, S.T, M.T

Best regards,
CEIE 2015 Committee
Department of Electrical Engineering,
State University of Malang

Letter_B-21.pdf
268kB

Additional Activities.pdf
571.8kB

Template Fullpaper.doc
56.5kB

Copyright.pdf
272.5kB

Re: Announcement | CEIE 2015 | State University of Malang

From: amir rullah (am9520012003@yahoo.com)

To: ceie2015@um.ac.id

Cc: ceie2015@um.ac.id

Date: Tuesday, 8 September 2015 at 06:49 pm GMT+7

Dear CEIE 2015 Commitee,

I inform you that beside presents paper (author) for the title "**Power Quality Analysis of Integration Photovoltaic Generator to Three Phase Grid under Variable Solar Irradiance Level**" **(B-21),** I also would like to follow International Journal Writing held by Telkomunika University of Ahmad Dahlan (UAD) Yokyakarta at 2 Oktober 2015.

This is my request and thanks a lot for your helping.

Regards: Amirullah
PhD Student ITS Surabaya
CEIE 2015 as Author

> On Tuesday, 8 September 2015, 18:32, amir rullah <am9520012003@yahoo.com> wrote:
>
> Dear Commitee of CEIE 2015 UM Malang,
>
> I inform you that my paper accept to present in CEIE 2015 on 3 October 2015. The title is "**Power Quality Analysis of Integration Photovoltaic Generator to Three Phase Grid under Variable Solar Irradiance Level**" **(B-21).** I would like to know:
> 1. How much registration fee as author (Indonesian PhD Student) with additional activity (following workshop writing strategy in international journal by telkomunika UAD)? IDR 750.000 or 1.500.000?
> 2. Is paper proceding (book) fee including registration fee or not? Including or excluding? If excluding, how much proceding/book is?
>
> This is my question thanks a lot.
>
> Regards: Amirullah
> PhD Student ITS Surabaya
> CEIE 2015 as Author
>
> On Thursday, 3 September 2015, 13:47, amir rullah <am9520012003@yahoo.com> wrote:
>
> Yth. Commitee of CEIE 2015 UM Malang

I inform you that my paper accept to present in CEIE 2015 on 3 October 2015. The title is "**Power Quality Analysis of Integration Photovoltaic Generator to Three Phase Grid in Variable Solar Irradiance Level**" **(B-21).** I would like to know:
1. How much registration fee as author (PhD Student) with additional activity (following workshop writing strategy in international journal by telkomunika UAD)? IDR 750.000 or 1.500.000?
2. Is paper proceding (book) fee including registration fee or not? Including or excluding? If excluding, how much proceding/book is?

This is my question thanks a lot.

Regards: Amirullah
PhD Student ITS Surabaya
CEIE 2015 as Author

On Wednesday, 2 September 2015, 19:54, ceie 2015 <ceie2015@um.ac.id> wrote:

Dear Amirullah,

It is a great pleasure to inform you that CEIE 2015 Committee organized by State University of Malang after peer reviewed by International Experts in the area has decided to ACCEPT your paper entitled "**Power Quality Analysis of Integration Photovoltaic Generator to Three Phase Grid in Variable Solar Irradiance Level**" ID Number **B-21** for presentation. Here we attached your paper review, and please submit your paper correction (abstract + full paper) before 20th September 2015.

Here we attached some documents to complete the registration. Click the following link to submit your full paper :http://elekro.um.ac.id/ceie/2015/member/

Please visit our website at elektro.um.ac.id/ceie/2015 (for registration and payment), or contact us at ceie2015@gmail.com

Sincerely yours,
Dr. Eng. Siti Sendari, S.T, M.T

Best regards,
CEIE 2015 Committee
Department of Electrical Engineering,
State University of Malang

Amirullah_Workshop Journal Writing Telkomunika.pdf
416.6kB

REGISTRATION | CEIE 2015 | State University of Malang

From: CEIE 2015 COMMITTEE (ceie2015@um.ac.id)

To: am9520012003@yahoo.com

Date: Wednesday, 16 September 2015 at 06:11 pm GMT+7

Dear Mr Amirullah -,

In our preparation for this conference we would to collect the author's data which very important for printing the certificates, preparation of additional activities, and etc. Here we attached form registration and please send back your data to the committee email (ceie2015@um.ac.id) before **September 20th, 2015**.

Alternative method to submit your data is using the available form in CEIE website. Please click at the following link: http://elektro.um.ac.id/ceie/2015/member (*need logged in and your full paper).

Please visit our website at elektro.um.ac.id/ceie/2015 (for registration and payment), and contact us at ceie2015@gmail.com for further information.

Sincerely yours,

Dr. Eng. Siti Sendari, S.T, M.T

Additional Activities.pdf
571.8kB

Form registrasi(english).doc
183.5kB

Re: Biaya Pemakalah Status Student S3

From: amir rullah (am9520012003@yahoo.com)

To: ceie2015@um.ac.id

Cc: ceie2015@um.ac.id

Date: Friday, 25 September 2015 at 04:11 pm GMT+7

Yth.6Panitia CEIE 2015
di-tempat

Saya kirimkan bukti scan pembayaran CEIE 2015 (Rp. 750.000,-) sebagai pemakalah untuk acara pada Sabtu 3 Okt 2015 di Graha Cakrawala UM Malang ke Rekening **BNI - MALANG 0357992850** atas nama: Ibu TRIYANNA WIDYANINGTYAS.

Demikian terima-kasih.

Hormat: Amirullah
Pemakalah CEIE 2015 UM Malang (B-21)
081-949649423

> On Friday, 18 September 2015, 7:15, amir rullah <am9520012003@yahoo.com> wrote:
>
> Baik terima-kasih atas informasinya.
>
> Hormat: Amirullah
>
> On Friday, 18 September 2015, 7:05, ceie 2015 <ceie2015@um.ac.id> wrote:
>
> Dear Amirullah,
>
> Terima kasih telah mengirimkan scan KTM sebagai tanda bukti berstatus mahasiswa S3 di Institut Teknologi Sepuluh Nopember Surabaya,
> Untuk biaya registrasi sejumlah Rp. 750.000,00 dikirimkan ke no rekening yang sudah tertera.
> Terkait dengan sertifikat, semua author akan mendapatkan sertifikat masing-masing sesuai dengan yang telah disubmit.
> Silahkan upload bukti pembayaran di website kami, segera kami akan mengkonfirmasi pembayaran anda dan mengirimkan bukti registrasi yang harus dibawa pada saat menghadiri konferensi.
>
> **Best regards,**
> **CEIE 2015 Committee**

Department of Electrical Engineering,
State University of Malang

2015-09-18 6:26 GMT+07:00 amir rullah <am9520012003@yahoo.com>:

Yth. Panitia Seminar CEIE 2015
UM Malang di-tempat

Saya sampaikan bukti scan KTM S3 ITS. Pihak yang datang ke acara seminar hanya penulis pertama saja
(1 orang/saya), sedangkan penulis 2 dan 3 (Ontoseno Penangsang dan Adi Soeprijanto/dosen S3 saya) tidak hadir di acara tsb.

Namun demikian ketika saya registrasi online dan untuk memenuhi permintaan panitia, saya daftarkan semua penulis (3 orang), supaya ketiga-tiganya (saya dan dosen saya) juga mendapatkan sertifikat sebagai pemakalah.

Saya rencana akan datang pada hari-H acara seminar pada Sabtu, 3 Oktober 2015 di UM Malang. Mohon maaf bahwa saya membatalkan kehadiran untuk mengikuti Workshop Telkomunika karena pada Jumat, 2 Oktober 2015 ada kegiatan di ITS. Jadi saya tidak bisa berpartisipasi pada acara tambahan (additional activity).

Mohon penjelasan tentang kontribusi dengan status saya pemakalah mahasiswa (S2/S3) dan kondisi diatas? Rp. 750.000,- or masih Rp. 1.500.000,- (di registrasi online).

Demikian atas perhatiannya disampaikan terima-kasih.

Hormat: Amirullah, ST, MT.
Pemakalah CEIE 2015 B-21

On Thursday, 17 September 2015, 20:33, ceie 2015 <ceie2015@um.ac.id> wrote:

Dear Amirullah,

Terima kasih sudah menghubungi kami, sebelum kami bisa menjawab pertanyaan saudara, apakah yang datang ke malang total ada 3 orang (2 author lain)?

Kemudian mengenai pendaftar sebagai murid membutuhkan scan KTM sebagai tanda bukti bahwa masih berstatus mahasiswa. untuk scan KTM silahkan dikirim ke email ini.

Untuk pembayaran detail bisa dilihat di link berikut :
http://elektro.um.ac.id/ceie/2015/news/id/registration_fee

Best regards,
CEIE 2015 Committee
Department of Electrical Engineering,
State University of Malang

2015-09-17 8:23 GMT+07:00 amir rullah <am9520012003@yahoo.com>:

> Yth. Panitia CEIE 2015
> UM Malang
> di-tempat
>
> Mohon jawaban dan solusi terhadap permasalahan di bawah.
>
> Hormat: Amirullah
>
> On Thursday, 17 September 2015, 8:20, amir rullah <am9520012003@yahoo.com> wrote:
>
> Yth. Panitia CEIE 2015
> UM Malang
> di-tempat
>
> Judul makalah saya: "Power Quality Analysis of Integration Photovoltaic Generator to Three Phase Grid under Variable Solar Irradiance Level" (B-21)
>
> Saya baru saja isi form sertifikat untuk isi nama pemakalah secara online status saya mahasiswa student (mahasiswa) S3 sekaligus mengikuti Workshop Penulisan Jurnal Internasional Telkomunika pada tanggal 2 Okt dan Seminar (Pemakalah) pada 3 Okt 2015 (Domestic Author) serta tidak ikut Bromo Tour (pass). Namun ketika submit saya dikenai biaya Rp. 1.500.000, padahal seharusnya saya dikenakan Rp. 750.000,- (Mhs S2/S3 sbg pemakalah), karena Workshop Telkomunika gratis dan saya tidak ikut Bromo Tour.
>
> Namun jika ternyata saya masih dikenakan Rp. 1.500.000,- (workshop Telkomunika tidak gratis), mohon status registrasi saya di-reset kembali supaya saya bisa daftar sebagai pemakalah Status Student S2/S3 dengan biaya Rp. 750.000,- (hanya ikut acara pada Sabtu 3 Okt 2015 sebagai pemakalah seminar saja).
>
> Demikian atas perhatian dan respon-nya disampaikan terima-kasih.
>
> Hormat:
>
> Amirullah, ST, MT.

Bukti Pembayaran CEIE 2015 Amirullah B-21.jpg
896.3kB

REGISTRATION | CEIE 2015 | State University of Malang

From: CEIE 2015 COMMITTEE (ceie2015@um.ac.id)

To: am9520012003@yahoo.com

Date: Friday, 25 September 2015 at 08:35 pm GMT+7

Dear Mr Amirullah -,

Warm greeetings from State University of Malang,

Congratulation for your acceptance of submitted paper. We are looking forward to meet you at the seminar on October 3th, 2015. Please inform to all of your members about registration as an audience. Please open the following link if you would to register your members as an audience of this conference.

REGISTER AS AN AUDIENCE

Here, we attached the registration proof. Please bring the registration proof when attend the conference and welcome to International Conference on Electrical Engineering, Informatics, and Its Education 2015.

Please visit our website at elektro.um.ac.id/ceie/2015 (for registration and payment), and contact us at ceie2015@um.ac.id for further information.

Sincerely yours,

CEIE 2015 Committee

[PAPER_1440090167]_registration_proof.pdf
204.5kB

Re: REGISTRATION | CEIE 2015 | State University of Malang

From: amir rullah (am9520012003@yahoo.com)

To: ceie2015@um.ac.id

Cc: ceie2015@um.ac.id

Date: Saturday, 26 September 2015 at 05:30 am GMT+7

Dear CEIE 2015 Commitee,

Thanks a lot for your confirmation of my registration. See you in UM Malang at Saturday, Oct 3, 2015.

Amirullah, ST, MT.
Author B-21

> On Friday, 25 September 2015, 20:35, CEIE 2015 COMMITTEE <ceie2015@um.ac.id> wrote:
>
> Dear Mr Amirullah -,
> Warm greeetings from State University of Malang,
> Congratulation for your acceptance of submitted paper. We are looking forward to meet you at the seminar on October 3th, 2015. Please inform to all of your members about registration as an audience. Please open the following link if you would to register your members as an audience of this conference.
>
> REGISTER AS AN AUDIENCE
> Here, we attached the registration proof. Please bring the registration proof when attend the conference and welcome to International Conference on Electrical Engineering, Informatics, and Its Education 2015.
> Please visit our website at elektro.um.ac.id/ceie/2015 (for registration and payment), and contact us at ceie2015@um.ac.id for further information.
>
> Sincerely yours,
>
> CEIE 2015 Committee

URGENT INFORMATION | CEIE 2015 | State University of Malang

From: CEIE 2015 COMMITTEE (ceie2015@um.ac.id)

To: am9520012003@yahoo.com

Date: Friday, 9 October 2015 at 05:29 pm GMT+7

Dear Mr Amirullah -,

All participants paper will be published in CEIE proceeding, and the high quality papers will be proposed to publish in a journal (and excluded from the CEIE proceeding).

However it should meet our minimum requirement:

1. Your proposal is writing in English and formatted based on IEEE conference format (double colomns-A4).
2. Your references also must listed in the bibliography as wall as explicitly stated in your paper sections (in-text citation) by using numbered system (author date must be changed). If the bibliography and the in-text citation i not matched, we will delete the unmatched bibliography list.
3. The graphic should be placed inside the text box.
4. The table is not a picture/screenshot of a table (we will do formatting for this table).

Due to fasten the reviewing process, please do the amendments until October 11, 2015.

We will not process the publication of late papers.

For more details, please contact us on ceie2015@um.ac.id.

Sincerely,

CEIE 2015 Committee

Schedule CEIE 2015.docx
32kB

Re: CAMERA READY | CEIE 2015 | STATE UNIVERSITY OF MALANG

From: ceie 2015 (ceie2015@um.ac.id)

To: am9520012003@yahoo.com

Date: Tuesday, 10 November 2015 at 09:49 am GMT+7

Penulis,

Berdasarkan review TELKOMNIKA, ada beberapa hal dari tulisan saudara yang masih perlu diperbaiki untuk dapat diterbitkan dalam jurnal tersebut. Perbaikan harus dikirim paling lambat pada tanggal 1 Desember ke redaksi telkomnika (telkomnika@ee.uad.ac.id) dan ceie2015 (ceie2015@um.ac.id) untuk tidak diterbitkan dalam proceeding ceie. Apabila batas waktu akhir pengiriman terlewatkan, maka paper anda **TIDAK** akan diterbeitkan di TELKOMNIKA (diterbitkan di prosiding CEIE2015)

Hasil review adalah sbb:

*** Secara umum**:
- Penulis diharapkan secara seksama mengikuti aturan dan kaidah sesuai check-list terlampir.
- **Results and discussion section**: The presentation of results should be simple and straightforward in style. You should improve your analyzing and also present the comparison between performance of your approach and other researches. Results given in figures should not be repeated in tables. This section report the most important findings, including results of statistical analyses as appropriate. It is very important to prove that your manuscript has a significant value and not trivial.
- **Prepare your figures in high quality** and created by yourself (not copy and paste from other parties). All legends in your figures MUST in English.

- Please ensure that: all references have been cited in your text; **Each citation should be written in the order of appearance in the text**; The references must be presented in numbering. The references must be integrated also with not less than two papers published on:

- TELKOMNIKA (http://journal.uad.ac.id/index.php/TELKOMNIKA, use **search** menu in right side)
- BEEI (http://journal.portalgaruda.org/index.php/eei, use **search** menu in right side)
- IJEEI (http://section.iaesonline.com/index.php/IJEEI, use **search** menu in right side)
- IAES Journals (You can find the issued at: http://iaesjournal.com, please use "**Search Paper**" facility in right top side of the website)

Secara khusus:

1. Power Quality Analysis ....

- Abstract is too long (max 200 words), avoid equations

- Introduction Section: 1st & 2nd paragraphs without references?? it's impossible??

- Enhance the image quality of the figure 1

- "Theory Section" is too long. Remove Irrelevant theories & backgrounds and ONLY present urgent information. Avoid to present long well-known information. Use some portions of the theories in Discussion section

- Too many Figures & Tables in this paper. Please ONLY select the main important Figures & Tables.

- Provide comparisons results in "Results & Discussion" section (to previously researches)

Terimakasih,

Panitia CEIE

Best regards,
CEIE 2015 Committee
Department of Electrical Engineering,
State University of Malang

> On Sat, Oct 31, 2015 at 12:50 PM, amir rullah <am9520012003@yahoo.com> wrote:
>
> It is okay thanks a lot for your information.
>
> Regards: Amirullah
> PhS Students of ITS Surabaya
>
> On Thursday, 29 October 2015, 10:12, ceie 2015 <ceie2015@um.ac.id> wrote:
>
> Dear Amirullah,
>
> Based on reviewing process, your paper is proposed to publish in a Telkomnika/JPH/JPS Journal (see attachment).
> Accepted paper will be excluded from the CEIE proceeding.
>
> We are still waiting the acceptance confirmation from the journal.
> In case your paper is rejected, we will publish your paper in CEIE proceeding.
>
> **Best regards,**
> **CEIE 2015 Committee**
> Department of Electrical Engineering,
> State University of Malang

CEIE2015-telkomnika.zip
542.8kB

Compose

Inbox 4.4K
Unread
Starred
Drafts 201
Sent
Archive
Spam
Deleted Items
Less

Views Show
Folders Show

Back Archive Move Delete Spam

Amirullah_kirim makalah untuk dimuat di Jurnal Internasional Telkomunika UAD 33

Yahoo/Inbox

amir rullah <am952(

Thu, 12 Nov 2015 at 9:27 pm

To:
telkomunika@ee.uad

Cc:
ceie2015@um.ac.id

Yth. Redaksi Jurnal Telkomunika
UAD Jogjakarta
di tempat

Saya kirim makalah untuk dimuat di Jurnal Internasional Telkomunika Universitas Ahmad Dahlan (UAD) Jogjakarta. Makalah berjudul "Power Quality Analysis of Integration Photovoltaic Generator to Three Phase Grid under Variable Solar Irradiance Level" (Amirullah, Ontoseno Penangsang, Adi Soeprijanto) dengan Kode B-21.

Makalah ini merupakan hasil seleksi 7 (tujuh) makalah Seminar Internasional CEIE 2015 pada 3 Oktober 2015 di UM Malang yang diusulkan untuk dimuat di Jurnal Internasional Telkomunika UAD.

Demikian atas perhatiannya disampaikan terima-kasih.

Hormat: Amirullah

Re: Fw: Amirullah_kirim makalah untuk dimuat di Jurnal Internasional Telkomunika UAD

From: amir rullah (am9520012003@yahoo.com)

To: thsutikno@ieee.org

Date: Wednesday, 16 December 2015 at 09:27 pm GMT+7

Pilih section selected paper (special invitation) maksudnya Pak Tole?

Amirullah

> On Wednesday, 16 December 2015, 20:37, Tole H Sutikno <thsutikno@ieee.org> wrote:
>
> Lewat online, dan pilih selected paper pd pilihan section
> On 16 Dec 2015 19:57, "amir rullah" <am9520012003@yahoo.com> wrote:
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> > Baik bapak untuk kirim revisi nanti lewat online (http://journal.uad.ac.id/index.php/TELKOMNIKA/user/register) atau email telkomnika@ee.uad.ac.id?
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> > Hormat: Amirullah
> >
> > On Wednesday, 16 December 2015, 18:48, Tole H Sutikno <thsutikno@ieee.org> wrote:
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> > >
> > > Amirullah
> > >
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> > >
> > > Sdh sy check sekilas, bhw paragraf 1 & 2 di introduction sama sekali tak ada references???
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sudah saya kerjakan juga bapak selain sesuai template saya revisi berdasarkan komentar dan saran dari reviewer jurnal telkomunika.untuk jelasnya mohon dicek di makalah terlampir.

Sent from Yahoo Mail on Android

From:"Tole H Sutikno" <thsutikno@ieee.org>
Date:Wed, Dec 16, 2015 at 5:42 PM
Subject:Re: Fw: Amirullah_kirim makalah untuk dimuat di Jurnal Internasional Telkomunika UAD

ada komentar tiap2 makalah Pak... tidak hanya template saja

2015-12-16 16:43 GMT+08:00 amir rullah <am9520012003@yahoo.com>:

> sudah direvisi bapak sesuai template jurnal telkomnika per-tanggal 12 nop lalu.amirullah
>
> Sent from Yahoo Mail on Android
>
> ---
>
> **From**:"Tole Sutikno" <thsutikno@gmail.com>
> **Date**:Wed, Dec 16, 2015 at 3:20 PM
> **Subject**:Re: Fw: Amirullah_kirim makalah untuk dimuat di Jurnal Internasional Telkomunika UAD
>
> Komentar revisi tiap makalah telah lama dikirimkan ke bu Siti (UM). Apakah makalah itu sdh hasil revisi?
> On 16 Dec 2015 16:06, "amir rullah" <am9520012003@yahoo.com> wrote:
>
> > Kepada:
> > Yth. Bapak Tole Sutikno
> > Pengelola Jurnal Telkomnika
> > UAD Yokyakarta
> >
> > Berkaitan dengan usulan jurnal saya, salah satu dari 7 jurnal Seminar Internasional CEIE Malang pada Sabtu 3 Oktober 2015 yang diusulkan untuk dimuat di Jurnal Telkomunika UAD Yokyakarta berjudul "Power Quality Analysis of Integration Photovoltaic Generator to Three Phase Grid under Variable Solar Irradiance Level" (Amirullah, Ontoseno Penangsang, Adi Soeprijanto), saya ingin menanyakan bagaimana hasil review pihak redaksi jurnal terhadap usulan tersebut? Apakah jurnal saya lolos untuk dimuat (diterbikan) atau ditolak? Kalau lolos kapan kira-kira dipublikasikan (online/hardcopy)?
> >
> > Demikian pertanyaan disampaikan, atas perhatian Bapak Tole disampaikan terima-kasih.
> >
> > Hormat: Amirullah, ST, MT.
> > Dosen TE Universitas Bhayangkara Surabaya
> > Mahasiswa S3 TE ITS Surabaya
> >
> > On Thursday, 12 November 2015, 21:27, amir rullah <am9520012003@yahoo.com> wrote:

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UAD Jogjakarta
di tempat

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Makalah ini merupakan hasil seleksi 7 (tujuh) makalah Seminar Internasional CEIE 2015 pada 3 Oktober 2015 di UM Malang yang diusulkan untuk dimuat di Jurnal Internasional Telkomunika UAD.

Demikian atas perhatiannya disampaikan terima-kasih.

Hormat: Amirullah
Dosen TE Ubhara Surabaya
Mahasiswa S3 ITS Surabaya

Re: Fw: Amirullah_kirim makalah untuk dimuat di Jurnal Internasional Telkomunika UAD

From: Jurnal Telkomnika (telkomnika@ee.uad.ac.id)

To: am9520012003@yahoo.com

Date: Thursday, 17 December 2015 at 06:11 pm GMT+7

Jika mengalami kesulitan, lakukan step 1 hingga t tanpa mengupload paper. Kirimkan fullpaper ke email ini

> On 17 Dec 2015 18:54, "amir rullah" <am9520012003@yahoo.com> wrote:
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> Yth. Bapak Tole Sutikno
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>
> Mohon penjelasan juga apa yang maksud perintah di bawah:
>
> 4. Click Upload on this page, which uploads the file from the computer to the journal's web site and **renames it following the journal's conventions.**
> 5. **Once the submission is uploaded**, click Save and Continue at the bottom of this page.
>
> Mohon maaf sebelumnya saya kirim pertanyaan ke alamat thsutikno@ieee.org dan thsutikno@gmail.com lagi karena hari ini sudah dua kali saya mengirim email ke alamat telkomnika@ee.uad.ac.id dan tole@journal.uad.ac.id (sesuai rekomendasi Bapak), namun tidak ada jawaban terhadap pertanyaan saya berkaitan dengan hal diatas.
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Dosen TE Universitas Bhayangkara Surabaya
Mahasiswa S3 TE ITS Surabaya

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Demikian atas perhatiannya disampaikan terima-kasih.

Hormat: Amirullah
Dosen TE Ubhara Surabaya
Mahasiswa S3 ITS Surabaya

Re: Biaya Pemakalah Status Student S3

From: amir rullah (am9520012003@yahoo.com)

To: ceie2015@um.ac.id

Cc: ceie2015@um.ac.id

Date: Friday, 18 September 2015 at 07:15 am GMT+7

Baik terima-kasih atas informasinya.

Hormat: Amirullah

> On Friday, 18 September 2015, 7:05, ceie 2015 <ceie2015@um.ac.id> wrote:
>
> Dear Amirullah,
>
> Terima kasih telah mengirimkan scan KTM sebagai tanda bukti berstatus mahasiswa S3 di Institut Teknologi Sepuluh Nopember Surabaya,
> Untuk biaya registrasi sejumlah Rp. 750.000,00 dikirimkan ke no rekening yang sudah tertera.
> Terkait dengan sertifikat, semua author akan mendapatkan sertifikat masing-masing sesuai dengan yang telah disubmit.
> Silahkan upload bukti pembayaran di website kami, segera kami akan mengkonfirmasi pembayaran anda dan mengirimkan bukti registrasi yang harus dibawa pada saat menghadiri konferensi.
>
> **Best regards,**
> **CEIE 2015 Committee**
> Department of Electrical Engineering,
> State University of Malang
>
> 2015-09-18 6:26 GMT+07:00 amir rullah <am9520012003@yahoo.com>:
>
> > Yth. Panitia Seminar CEIE 2015
> > UM Malang di-tempat
> >
> > Saya sampaikan bukti scan KTM S3 ITS. Pihak yang datang ke acara seminar hanya penulis pertama saja
> > (1 orang/saya), sedangkan penulis 2 dan 3 (Ontoseno Penangsang dan Adi Soeprijanto/dosen S3 saya) tidak hadir di acara tsb.
> >
> > Namun demikian ketika saya registrasi online dan untuk memenuhi permintaan panitia, saya daftarkan semua penulis (3 orang), supaya ketiga-tiganya (saya dan dosen saya) juga mendapatkan sertifikat sebagai pemakalah.
> >
> > Saya rencana akan datang pada hari-H acara seminar pada Sabtu, 3 Oktober 2015 di UM Malang. Mohon maaf bahwa saya membatalkan kehadiran untuk mengikuti Workshop Telkomunika karena

pada Jumat, 2 Oktober 2015 ada kegiatan di ITS. Jadi saya tidak bisa berpartisipasi pada acara tambahan (additional activity).

Mohon penjelasan tentang kontribusi dengan status saya pemakalah mahasiswa (S2/S3) dan kondisi diatas? Rp. 750.000,- or masih Rp. 1.500.000,- (di registrasi online).

Demikian atas perhatiannya disampaikan terima-kasih.

Hormat: Amirullah, ST, MT.
Pemakalah CEIE 2015 B-21

On Thursday, 17 September 2015, 20:33, ceie 2015 <ceie2015@um.ac.id> wrote:

Dear Amirullah,

Terima kasih sudah menghubungi kami, sebelum kami bisa menjawab pertanyaan saudara, apakah yang datang ke malang total ada 3 orang (2 author lain)?

Kemudian mengenai pendaftar sebagai murid membutuhkan scan KTM sebagai tanda bukti bahwa masih berstatus mahasiswa. untuk scan KTM silahkan dikirim ke email ini.

Untuk pembayaran detail bisa dilihat di link berikut :
http://elektro.um.ac.id/ceie/2015/news/id/registration_fee

Best regards,
CEIE 2015 Committee
Department of Electrical Engineering,
State University of Malang

2015-09-17 8:23 GMT+07:00 amir rullah <am9520012003@yahoo.com>:

> Yth. Panitia CEIE 2015
> UM Malang
> di-tempat
>
> Mohon jawaban dan solusi terhadap permasalahan di bawah.
>
> Hormat: Amirullah
>
> On Thursday, 17 September 2015, 8:20, amir rullah <am9520012003@yahoo.com> wrote:

Yth. Panitia CEIE 2015
UM Malang
di-tempat

Judul makalah saya: "Power Quality Analysis of Integration Photovoltaic Generator to Three Phase Grid under Variable Solar Irradiance Level" (B-21)

Saya baru saja isi form sertifikat untuk isi nama pemakalah secara online status saya mahasiswa student (mahasiswa) S3 sekaligus mengikuti Workshop Penulisan Jurnal Internasional Telkomunika pada tanggal 2 Okt dan Seminar (Pemakalah) pada 3 Okt 2015 (Domestic Author) serta tidak ikut Bromo Tour (pass). Namun ketika submit saya dikenai biaya Rp. 1.500.000, padahal seharusnya saya dikenakan Rp. 750.000,- (Mhs S2/S3 sbg pemakalah), karena Workshop Telkomunika gratis dan saya tidak ikut Bromo Tour.

Namun jika ternyata saya masih dikenakan Rp. 1.500.000,- (workshop Telkomunika tidak gratis), mohon status registrasi saya di-reset kembali supaya saya bisa daftar sebagai pemakalah Status Student S2/S3 dengan biaya Rp. 750.000,- (hanya ikut acara pada Sabtu 3 Okt 2015 sebagai pemakalah seminar saja).

Demikian atas perhatian dan respon-nya disampaikan terima-kasih.

Hormat:

Amirullah, ST, MT.

Re: Fw: Amirullah_kirim makalah untuk dimuat di Jurnal Internasional Telkomunika UAD

From: amir rullah (am9520012003@yahoo.com)

To: telkomnika@ee.uad.ac.id

Cc: tole@journal.uad.ac.id

Date: Saturday, 19 December 2015 at 11:41 am GMT+7

Yth. Bapak Tole Sutikno
Pengelola Jurnal Telkomnika UAD Yokyakarta
di-tempat

Terlampir jurnal saya berjudul "Power Quality Analysis of Integration Photovoltaic Generator to Three Phase Grid under Variable Solar Irradiance Level" (Amirullah, Ontoseno Penangsang, Adi Soeprijanto) dan kontak alamat penulis (Revisi_Amirullah_where is your address) untuk dimuat di Jurnal Telkomnika (special invitation).

Pengiriman jurnal ke alamat email diatas, untuk menindaklajuti saran pengelola jurnal sebelumnya, untuk mengikuti step 1 sd 4 hingga tahap confirmation (online submission) tanpa upload jurnal.

Demikian atas perhatian dan review lebih lanjut terhadap makalah jurnal disampaikan terima-kasih.

Hormat,

Amirullah, ST, MT.
Dosen Universitas Bhayangkara Surabaya
Mhs S3 Teknik Elektro (Power System) ITS Surabaya

> On Thursday, 17 December 2015, 18:11, Jurnal Telkomnika <telkomnika@ee.uad.ac.id> wrote:
>
> Jika mengalami kesulitan, lakukan step 1 hingga t tanpa mengupload paper. Kirimkan fullpaper ke email ini
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> >
> > Mohon penjelasan juga apa yang maksud perintah di bawah:
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> > 4. Click Upload on this page, which uploads the file from the computer to the journal's web site and **renames it following the journal's conventions.**

5. **Once the submission is uploaded**, click Save and Continue at the bottom of this page.

Mohon maaf sebelumnya saya kirim pertanyaan ke alamat thsutikno@ieee.org dan thsutikno@gmail.com lagi karena hari ini sudah dua kali saya mengirim email ke alamat telkomnika@ee.uad.ac.id dan tole@journal.uad.ac.id (sesuai rekomendasi Bapak), namun tidak ada jawaban terhadap pertanyaan saya berkaitan dengan hal diatas.

Demikian atas bantuannya terima-kasih.

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Sdh sy check sekilas, bhw paragraf 1 & 2 di introduction sama sekali tak ada references???
On 16 Dec 2015 19:14, "amir rullah" <am9520012003@yahoo.com> wrote:

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Yth. Prof. Dr. Ir. Ontoseno Penangsang, M.Sc.
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Bersama ini saya sampaikan bahwa makalah saya berjudul: "Power Quality Analysis of Integration Photovoltaic Generator to Three Phase Grid under Variable Solar Irradiance Level" (Amirullah, Ontoseno Penangsang, Adi Soeprijanto) statusnya diterima dengan sedikit revisi **(accepted with minor revision)** di Jurnal Telkomnika Universitas Ahmad Dahlan (UAD) Yokyakarta Volume 14 Nomor 1 Edisi Maret 2016 (Scopus Q3) dengan link http://journal.uad.ac.id/index.php/TELKOMNIKA/issue/view/236. Makalah ini merupakan salah satu dari 7 makalah (dari total 83 makalah) Seminar Internasional CEIE 2015 Universitas Negeri Malang (UM) pada 3 Oktober 2015 yang diusulkan oleh Panitia CEIE untuk dimuat di Jurnal Telkomnika UAD.

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Lampiran 2

Bukti Pendukung

Lampiran 2.1

Naskah Makalah Submitted ke International Conference on Electrical and Informatics and Its Education (CEIE) 2015 di UM Malang

Power Quality Analysis of Integration Photovoltaic Generator to Three Phase Grid under Variable Solar Irradiance Level

Amirullah[1,4)],
[1,2,3)]Electrical Engineering Department,
Industrial Technology Faculty,
Kampus ITS Sukolilo Surabaya
Jl. Arief Rahman Hakim Surabaya Indonesia 60111
amirullah14@mhs.ee.its.ac.id,
am9520012003@yahoo.com[1,4)]

Ontoseno Penangsang[2)], Adi Soeprijanto[3)]
[4)]Electrical Engineering Study Program,
Engineering Faculty,
University of Bhayangkara Surabaya
Jl. Ahmad Yani 114 Surabaya Indonesia
Zenno_379@yahoo.com[2)], adisup@ee.its.ac.id[3)]

Abstract-Objective of research is to analyze the influence of solar irradiance and integration of PV generator to power quality of three phase grid on the constant temperature and load, based on changes in some level of integration of PV generator. Power quality aspects studied are fluctuation or changing, and harmonics of voltage and current on eight scenarios PV generator connected to three-phase grid. Passive filter circuit model used is a double band pass (double tuned). The circuit model simulations conducted to determine the voltage and current curves three-phase grid. There are two scenarios simulations done that before and after the double tuned passive filter installed. Wherein each consisting of four scenarios for a total of eight scenarios integration of PV generators. Next stage is to determine voltage, current, voltage and current Total Harmonic Distortion (THD) on Point Common Coupling (PCC) Bus refers to the IEEE Standard 519-1992 on each scenario grid. Research shows that voltage and current values on the Bus PCC grid before use double tuned passive filter on the condition only connect single generator (PV1) is still stable. However, if the PV generator connected to the three phase grid, amounted to more than one generation (PV1+PV2 and PV1+PV2+ PV3), voltage and current grid becomes unstable (fluctuation). At the level of solar radiation remains, the greater number of PV generators connected to the grid three-phase, then the values of voltage and current THD increases. At the level of solar irradiance increases, average THD of voltage and current grid also increased. Avarage THD of voltage and current grid is reduced after double tuned passive filter installed. Thus double tuned passive filter able to improve profile of voltage and current THD grid as a result of the integration of a number of PV power generators in the three-phase grid according IEEE Standard 519-1992. Simulation and analysis of this research use Matlab/Simulink.

Keywords-Power Quality; Total Harmonic Distortion (THD); Photovoltaic Generator; Grid; Irradiance.

I. INTRODUCTION

Among the renewable energy resources, the energy due to the photovoltaic (PV) effect can be considered as the most important resource because it can be installed in any location, abundant energy, and produces sustainable solar irradiance energy. Despite of discontinuous nature of sunlight, solar energy is widely available and is free. Application of PV as a electrical energy source shows increasing trend both in the implementation of spead area over the world and installed capacity of power generator. The trend is triggered by many factors such as the increasing of fossil fuels cost, declination of production costs per kW from PV, and also development of solar cell technologies that cause the PV power conversion more efficient.

PV module represents the fundamental power conversion unit of PV generator system. The output of PV charactheristic module depends on solar irradiance, cell temperature, and output voltage of the PV module. Since PV module has a nonlinear characteristics, it is necessary to model it for the design and simulation maximum power point tracking (MPPT) for PV system applications. PV generation system can either be operated in an isolated system or connected to the grid to form an integrated system, and with sources of renewable electrical energy can form distributed renewable energy generation. One aspect of the inclusion of PV as part of distributed generation is the quality aspects of the power generated from the operation for example fluctuations, and voltage and current harmonics.

Mathematical modeling and simulation of PV generation systems has been conducted to determine the IV characteristics, P-I, P-V, current harmonics, and power/reactive voltage on load side connected to the grid of the phase [1], [2], and [3]. The weakness of the study is the number of PV generator that are used on average only a single PV generation and grid connected in one phase, so that current and voltage harmonics generated due to the presence of the inverter in PV generating system is not very significant. Research to assess the impact of the integration of a number of the PV generator to power quality at different solar irradiation level and daily load consumption based on changes in the level of PV integration is already done. The disadvantage is a PV generator that is used only to connect to the single phase grid and harmonic analysis is only performed on the harmonic voltage [4]. Research on the effects of installation of PV generator to power quality in

three phase industrial and residential distribution network has been discussed. However, PV generator which installed is still static which is based on level of solar irradiance, temperature, and current and voltage harmonic generated by PV generator with a fixed value [5].

Objective of research is to analyze the influence of solar irradiance and integration of PV generator to power quality of three phase grid on the constant temperature and load, based on changes in some level of integration of PV generator. Power quality aspects studied are fluctuation or changing, and harmonics of voltage and current on eight scenarios PV generator connected to three-phase grid. The rest of this paper is orginezed as follow. Section II describes power quality and harmonic, microgrid, photovoltaic system, mathematical model of PV cell and panel, maximum power point tracking (MPPT), and filter pasif shunt. Section III shows research method, model, and parameter of three PV generator system connected to three-phase grid. Then we will describe influence of solar irradiance and integration of PV generator to voltage, current, voltage and current THD of three phase grid on the constant temperature and load, based on changes in some level of integration of PV generator in Section IV. In this section. example cases studied are presented and the results are verified with those of Matlab/Simulink software. Finally, the paper in concluded in Section V.

II. THEORY

A. *Power Quality and Harmonics*

Power quality has become a major concern in the electric world in recent decades. This parameter is the electrical power used by consumers, not to damage or reduce the life of the equipment, and the power, if used efficiently. Power quality means the quality of voltage and current. Voltage and current quality is determined based on the value or the tolerance limit of the equipment used. In general, current and voltage wave form of the pure sinusoidal waveform. One problem that arises is the wave of current and voltage is not sinusoidal or defects caused by the emergence of harmonics generated by the power system [6]. The term used to describe deviations harmonics sinusoidal wave associated with the current and voltage of different amplitude and frequency. Changes in current and voltage waveforms caused by harmonics will disrupt the electrical distribution system and lower the quality of the system power. In the electric power system, definition of harmonics can be described as a distorted periodic waveform at steady state are caused by the interaction between the shape of a sine wave at the fundamental frequency system with another wave components which are integer multiples of the frequency of the fundamental frequency sources. Figure 1 shows the signal waveform distortion due to harmonics.

Harmonic distortion explained through several key parameters to describe the effects of harmonics on power system components. The first parameter is the Total Harmonic Distortion (THD). THD is the ratio of the rms value of harmonic components to the rms value of the fundamental component and is commonly expressed in percent (%). This index is used to measure deviations periodic waveforms containing harmonics of a perfect sine wave [7]. On a perfect sine wave THD value is zero percent. Voltage THD value is expressed in Equation 1 as follows:

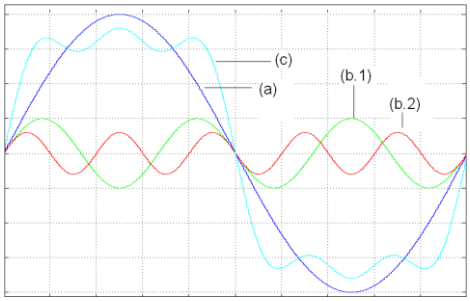


Figure 1. Distorted Wave resulted by Harmonics. Description: a = wave at the fundamental frequency, b.1 = 3rd harmonic wave, b.2 = wave harmonics 5th, c. = Distorted Wave

$$THD_V = \frac{\sqrt{\sum_{n=2}^{k} U_n^2}}{U_1} \times 100\ \% \quad (1)$$

Description: U_n = harmonic component; U_1 = the fundamental component; K = maximum harmonic components

The second parameter is the Individual Harmonic Distortion (IHD) is the ratio of rms value of individual harmonics to rms value of the fundamental component. The third parameter is the Total Demand Distortion (TDD) or THD_I is amount of current harmonic distortion and defined in the following equation [7]:

$$THD_I = \frac{\sqrt{\sum_{n=2}^{k} I_n^2}}{I_L} \times 100\ \% \quad (2)$$

Where I_L is the maximum load current (for 15 or 30 minutes) at the fundamental frequency at the Point of Common Coupling (PCC), calculated from the average current of the maximum load of 12 months earlier.

THD value of the maximum allowable for each country is different depending on the standard used. THD standards most often used in electric power system is the IEEE Standard 519-1992. There are two criteria that are used in the analysis of harmonic distortion that limits voltage distortion and current distortion limits. Table I shows the limit distortion (THD) voltage on power distribution systems. Table II shows the current distortion limit is based on the IEEE Standard 519-1992 [8].

B. *Microgrid*

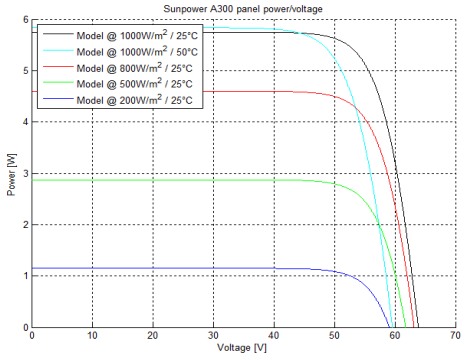
Microgrid is a group of loads and generators operating as a controlled system that provides electricity to a particular region are relatively small [9]. Microgrid is a technology used to overcome the crisis of mineral resources. Usually in microgrid, use an energy from renewable energy

sources. With the development of microgrid can contribute to reduce emissions and mitigate the effects of climate change. This is because currently being developed technology that dispersed generation units using renewable energy sources and micro sources that have very low emission levels [10].

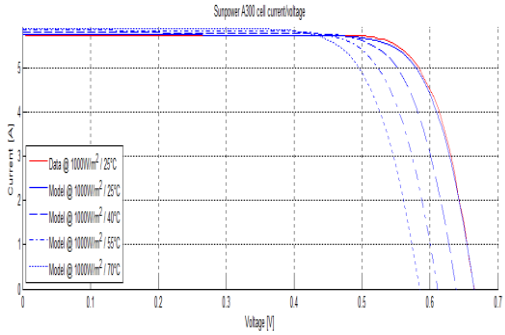
At the microgrid, the energy source and the load can be connected (on-grid) and disconnected to the distribution network (off-grid). At the time of microgrid disconnected with the distribution network where interconnection switch in an open state, microgrid should be able to supply the local load to the generator itself because in this condition the electrical grid can not help supply power to a load, this condition is called islanded mode. Besides microgrid should be able to meet the load requirements, microgrid should also be able to ensure the quality of frequency and voltage, because in general the disorder arises when the process of change from state grid-connected to state islanded mode.

C. Photovoltaic System

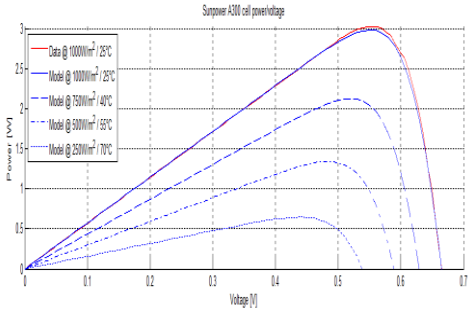
PV panel working principle is almost same as diode semiconductor devices. When sunlight reaches the surface of the solar panel, then the photons with a certain energy level will be absorbed, thus freeing electrons from their atomic bonds and the flow of electric current. The solar panels generate the current that varies depending on the voltage of the solar panel. Current-voltage characteristics show the relationship. When the voltage of the solar panel is equal to zero, short circuit current (I_{SC}), which is proportional to the amount of solar radiation on the solar panel can be measured. I_{SC} value rises with increasing temperature, although the standard temperature recorded for the short circuit current is 25^0 C. If the current solar panel is equal to zero, the solar panel is described as an open circuit. The voltage on open circuit or open-circuit voltage (V_{OC}), depending on the amount of solar radiation. This dependence is logarithmic, and decline more rapidly with increased temperatures exceeding the speed increase in I_{sc}. The maximum power of solar panels and solar panel efficiency will decrease with increasing temperature. Solar panels, increasing the temperature of 25^0C resulted in a decrease of about 10% power. Figure 2 shows the curve of the PV panel karakteristisk [11].



(a) I-V Curve on fixed temperature and irradiance change



(b) I-V curve on fixed irradiance and temperature change



(c) P-V curve on temperature change

Figure 2. Characteristic Curve of Panel PV (Tipe MSX-60)

D. Mathematical Model of PV Cell and Panel

PV cell equivalent circuit shown in Figure 3 consists of a power supply and a diode. Current photo (I_{ph}) depending on solar radiation (G), and temperature (T) environment.

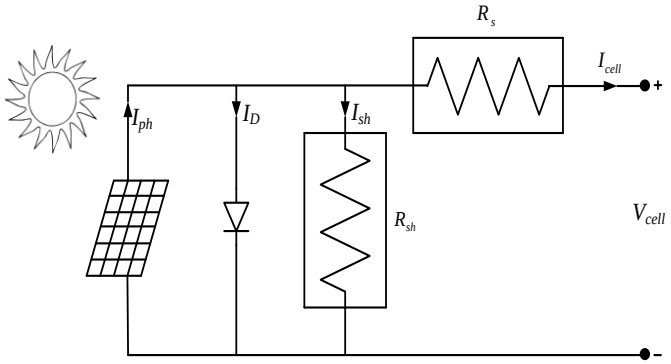


Figure 3. Equivalent Circuit of PV Cell

The conditions described in the Equation 3. I_{ph} (Tref) is the photo stream at a nominal temperature T_{ref}. On the other hand, Equation 4 gives the formula of photo current at a nominal temperature K_0 is a constant that is expressed in Equation 5. G_{ref} and I_{sc} respectively nominal radiation provided by the factory short-circuit current. This equation refer to Figure 2 for a single PV cell [12].

$$I_{ph} = I_{ph}(T_{ref}) \times \left(1 + K_0(T - T_{ref})\right) \quad (3)$$

$$I_{ph}(T_{ref}) = \frac{G}{G_{ref}} \times I_{sc}(T_{ref}) \quad (4)$$

$$K_0 = \frac{I_{sc}(T) - I_{sc}(T_{ref})}{T - T_{ref}} \quad (5)$$

Taking into account that the environment temperature is set at a certain nominal value, then the next PV flow only depends on solar irradiace expressed in Equation 6.

$$I_{ph} = I_{ph}(T_{ref}) = \frac{G}{G_{ref}} \times I_{sc}(T_{ref}) \quad (6)$$

Characteristics of diode current (I_D) is expressed in Equation 7, where the value of saturation current I_O is a diode, where V_T represents the thermal voltage.

$$I_D = \left(I_o e^{V_D / V_T} - 1 \right) \quad (7)$$

Where; $V_D = V_{cell} + (I_{cell} \times R_s)$

Furthermore, by using the Kirchoff Law, shunt current I_{sh} is defined in the following equation:

$$I_{sh} = \frac{V_D}{R_{sh}} \quad (8)$$

By calculating Equation 1 and 5, and applying current Kirchoff's Law, I-V characteristics PV shown in Equation 9.

$$I_{cell} = I_{ph} - I_D - I_{sh}$$

$$I_{cell} = I_{ph} - \left(I_o e^{V_D / V_T} - 1 \right) - \left(\frac{V_D}{R_{sh}} \right) \quad (9)$$

E. Maximum Power Point Tracking

Maximum Power Point Tracking (MPPT) produces maximum power at the solar irradiation conditions and the environment temperature change. One method MPPT most widely used is Perturb and Observe (P and O). The main advantage of this technique is that the MPPT search is done independently on environmental conditions, although its use is necessary for the current and voltage sensors. On the other hand, the method of constant voltage method is used to keep the voltage generated by the constant value PV terminal and according to the MPPT line [13]. Therefore, in this method, the terminal voltage PV is set constant and is at its maximum.

F. Filter Pasif Shunt

Passive filter technique is one of the most widely used method to mitigate or reduce harmonics on the power grid. Besides reducing passive harmonic filter can be used for optimization of reactive power into the power grid. This equipment consists of passive elements such as resistors, capacitors and inductors. This filter is permanent and once installed they become part of the network and need to be redesigned to obtain different filter frequencies. Passive filter is still considered the best in the network system of three-phase four-wire. The majority of them are low-pass filter that is tuned to the desired frequency. Shunt filter using passive components and offer better harmonics reduction, especially in the harmonic 3, 5, and 7. Some models include a passive filter [14]:

1. Band pass filter (single atau double tuned).
2. High pass filters (first, second, third-order or C-type).
3. Composite filter.

All types of filters are installed parallel to the line as shown in Figure 4 [15]. Increased order harmonics create filters become more efficient but reduce the ease when designing. They provide a low impedance at the frequency prescribed. When connected shunt, the passive filter is designed to reduce the current harmonics. Because the shape is shunt causes the filter serves as a load for supplying 30-50% if the load current flowing in an electric propulsion device. Economic aspects shows that shunt filter is more economical than the filter series because both are designed only to current harmonics. Therefore they need a size L and C are relatively smaller, thereby reducing the cost of manufacture of filter.

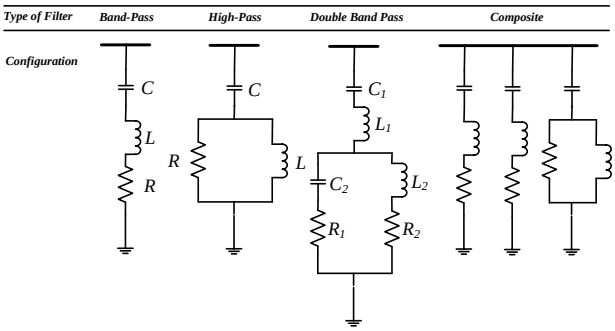


Figure 4. Model of Passive Filter

The relationship between impedance and frequency filters ditujukkan the following equation [14]:

$$Z_f(S) = \frac{1 + R_f C_f S + L_f C_f S^2}{C_f S} \quad (10)$$

Where S = j2πf

In general, filter capacitor C_f is determined from the reactive power compensation Q_c needed to increase the value of power factor, which is expressed in the equation:

$$C_f = \frac{1}{2\pi f_1 U^2} \left(1 - \frac{1}{n^2} \right) \quad (11)$$

Where U is the voltage source, n is the order harmonics, and f_1 is the fundamental frequency. At the frequency $f_n = nf_1$ harmonic filter reactors will produce a series resonance.

$$L_f \, 2\pi f_n = \frac{1}{C_f \, 2\pi f_n} \quad (12)$$

Filter inductance value can be determined from the following equation:

$$L_f = \frac{1}{(2\pi f_n)^2 C_f} \quad (13)$$

The value of impedance-low Rf for each single tuned filter caused by filter quality factor Q.

$$R_f = 2\pi f_1 n \frac{L_f}{Q} \quad (14)$$

Filter quality factor Q determines the sharpness of tuning. Typically, the Q value ranges between 20 and 100. filter with a high Q value gives the best reduction of the harmonic distortion. Interaction between the filter reactance Ls generate additional condition on the parallel resonance frequency of the series resonance of the filter.

$$f_p = \frac{1}{2\pi(\sqrt{(L_f + L_s)C_f}} \quad (15)$$

III. METHODOLOGY

A. Research Method

Figure 5 shows a model of a single PV power system connected three phase grid [12]. The series of DC/DC converter consists of a boost converter circuit that functions to raise the voltage of the DC output of the PV generator. DC output voltage of the boost converter circuit is then converted by the DC/AC inverter into a three-phase AC voltage to the three-phase grid. Single PV generator model is then used as a reference to create a model for many (multi) PV generators connected to the grid via a three-phase distribution transformer (Figure 6). The study used three groups of models of PV generators with the active power of 100 kW each. Besides connecting the three-phase grid, the PV generator is also connected to the three groups of three phase load with active power 20 kW respectively. The research objective was to analyze the influence of solar irradiance and integration of a number of PV generator against temperature and power quality at constant load, based on changes in the level of integration of PV. Power quality aspects studied is the fluctuation, and harmonics of voltage and current on eight scenarios PV generator connected to three phase grid, as follow:

1. Before double tuned passive filter installed
   a. Irradiance 400 W/m^2 on the condition 1, 2, and 3 of model PV generator connected to three phase grid.
   b. Irradiance 600 W/m^2 on the condition 1, 2, and 3 of model PV generator connected to three phase grid.
   c. Irradiance 800 W/m^2 on the condition 1, 2, and 3 of model PV generator connected to three phase grid.
   d. Irradiance 1000 W/m^2 on the condition 1, 2, and 3 of model PV generator connected to three phase grid.
2. After double tuned passive filter installed
   a. Irradiance 400 W/m^2 on the condition 1, 2, and 3 of model PV generator connected to three phase grid.
   b. Irradiance 600 W/m^2 on the condition 1, 2, and 3 of model PV generator connected to three phase grid.
   c. Irradiance 800 W/m^2 on the condition 1, 2, and 3 of model PV generator connected to three phase grid.
   d. Irradiance 1000 W/m^2 on the condition 1, 2, and 3 of model PV generator connected to three phase grid.

Passive filter circuit model used is a double band pass (double tuned). The circuit model simulations conducted to determine the voltage and current curves three-phase grid. There are two scenarios simulations done that before and after the double tuned passive filter installed. Wherein each consisting of four scenarios for a total of eight scenarios integration of PV generators. The next stage is to determine the value of voltage and current Total Harmonic Distortion (THD) on each scenario grid. The final step is to compare the value of voltage, current, voltage and current THD grid (Bus Point Common Coupling- PCC) refers to the IEEE Standard 519-1992 as the basis for determining the level of power quality at the eight scenarios radiation levels and integration of grid connected PV generator model three phase. Simulation and analysis of this research use software Matlab/Simulink.

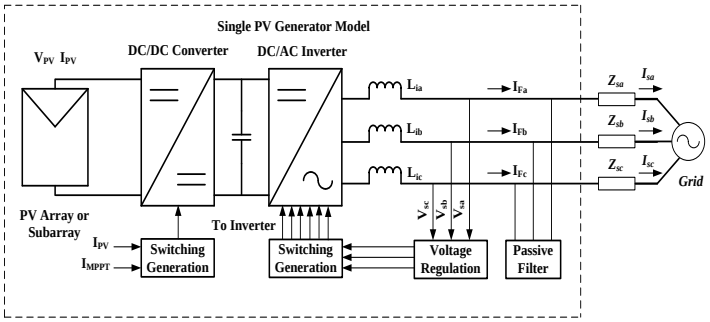


Figure 5. Model of single PV generator system connected to three-phase grid

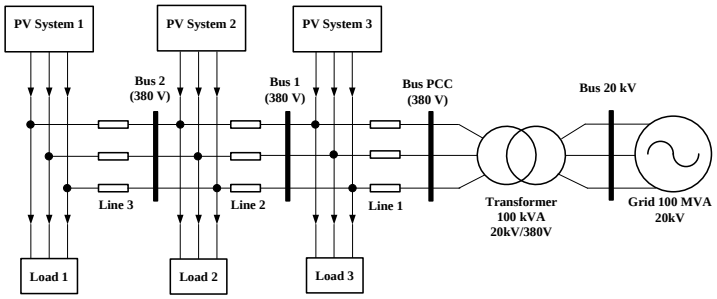


Figure 6. Proposed model of three PV generator system connected to three-phase grid

B. Simulation Parameter

Table III shows the equipment, parameters, and values of simulation integration of the three models of PV generators connected to the grid three phase.

IV. RESULT AND DISCUSSION

Table IV shows the value of voltages phase and THD voltage grid in three models of integration of PV generators and four different levels of irradiance connected to three phase grid before and after using double tuned passive filter.

Figure 7 shows the curve of the grid voltage on the two models of integration of PV generators connected to the grid three-phase (solar radiation of 1000 W / m2) on the bus point of common coupling (PCC) (i) without the passive filter and (ii) use double tuned passive filter.

Figure 8 shows the spectrum of harmonics voltage grid at phase A in two models of integration of PV generator connected to the three-phase grid (solar irradiance of 1000 W/m2) on the bus point of common coupling (PCC) (i) before and (ii) after using passive filters double tuned.

Figure 9 shows a graph of the value of harmonics (THD) average voltage on three models of integration of generation PV and four levels of solar irradiance connected to the three-phase grid on the bus point of common coupling (PCC) (i) before and (ii) after using double tuned passive filter.

Table V shows the value of the current phase and current THD grid on three models of integration of PV generators and four different levels of irradiance connected to three phase grid before and after using double tuned passive filter.

Figure 10 shows grid current curve on two models of integration of PV generators connected to the grid three-phase (solar irradiance 1000 W m2) on the bus point of common coupling (PCC) (i) before and (ii) using double tuned passive filter.

Figure 11 shows the spectrum of harmonic current grid phase A in two models of integration of generation PV connected to the three-phase grid (irradiance of 1000 W / m2) on the bus point of common coupling (PCC)) (i) before and (ii) using double tuned passive filter.

Figure 12 shows a graph of the value of harmonics (THD) the average current on the three models of integration of generation PV and four levels of solar irradiance connected to the three grid on the bus point of common coupling (PCC) (i) before and (ii) after using double tuned passive filters.

Table IV shows that the value of the grid voltage before use double tuned passive filter on the condition only connect one generator (PV1) remained stable (220 Volt). However, if the PV generator connected to the grid three-phase, amounted to more than one generation (PV1+PV2 and PV1+PV2+PV3), grid voltage at PCC Bus decrease to 212 Volt or 3.36%. After using double tuned passive filter, grid voltage of PV generator integration at all levels (PV1, PV2 + PV1, and PV1+PV2+PV3) value becomes stable (220 Volt). In the condition without double tuned passive filter the largest THD average of grid voltage is generated on the condition of all PV generators connected to the three phase grid (PV1 + PV2 + PV3) and the irradiance level of 800 W/m2 at 4.11%. The smallest value of average grid voltage THD is produced on the condition of the PV generators connected to the grid three-phase (PV1) and the radiation level of 400 W/m2 at 0.52%. On the condition of using double tuned passive filter, the largest THD average of grid voltage is generated on the condition of all PV generators connected to the three phase grid (PV1 + PV2 + PV3) and the irradiance level of 800 W/m2 at 0.19%. The smallest average of grid voltage THD produced on the condition of the PV generators connected to the grid three-phase (PV1) and the radiation level of 400 W / m2 of 0.03%. Figure 7 and 8 shows that at the level of solar irradiance remains, the greater number of PV generators connected to three-phase grid, then the greater the value of the voltage THD. Figure 9 also shows that the level of solar irradiace increases, THD average of voltage grid will also increase. THD average of grid voltage is reduced after double tuned passive filter installed. Thus double tuned passive filter able to repair grid voltage THD profile due to the integration of a number of PV power generators to three-phase grid.

Table V shows that the current value of grid before use double tuned passive filter on the condition only connect one and two generators (PV1 and PV1+PV1) was stable (6.8 Volt). However, if the PV generator connected to the three phase grid is three generators (PV1+PV2+PV3), the current grid in Bus PCC appears unbalanced currents between 6.8 up to 9.2 Ampere. After using double tuned passive filter grid current value on the condition only connect one and two generators (PV1 and PV1+ PV2) was stable (6.8 Ampere). However, if all PV generator connected to the three phase grid (PV1 + PV2 + PV3), the current grid in Bus PCC increase to 7.5 Ampere or 10.29%. In the condition without double tuned passive filter THD average current average grid generated on the condition of the three largest PV generators connected to the grid three-phase (PV1+PV2+PV3) and the irradiance level of 800 W/m2 at 1.93%. The smallest THD avarage of grid current is produced on the condition of the PV generators connected to the grid three-phase (PV1) and irradiance level of 400 W/m2 at 0.07%. On the condition of using double tuned passive filter, the largest of THD average grid voltage is generated on the condition all PV generators connected to three phase grid (PV1 + PV2 + PV3) and irradiance level of 800 W/m2 of 0.05%. The smallest average THD of grid current is produced on the condition of the PV generators connected to the grid three-phase (PV1) and the radiation level of 400 W/m2 at 0.00%. Based on Figure 10 and 11 shows that the level of solar irradiance remains, the greater number of PV generators connected to the three phase grid, then the greater the value of current THD. Figure 12 also shows that the level of solar irradiance increases, the average THD of current grid also increased. Avarage THD of grid voltage is reduced after double tuned passive filter installed. Thus the double tuned passive filter able to fix the grid current THD profile due to the integration of a number of PV power generators in three-phase grid.

V. CONCLUSION

Voltage and current values on the Bus PCC grid before use double tuned passive filter on the condition only connect single generator (PV1) is still stable. However, if the PV generator connected to the three phase grid, amounted to more than one generation (PV1+PV2 and PV1+PV2+ PV3), voltage and current grid becomes unstable (fluctuation). At the level of solar radiation remains, the greater number of PV generators connected to the grid three-phase, then the values of voltage and current THD increases. At the level of solar irradiance increases, average THD of voltage and current grid also increased. Avarage THD of voltage and current grid is reduced after double tuned passive filter installed. Thus double tuned passive filter able to improve profile of voltage and current THD grid as a result of the integration of a number of PV power generators in the three-phase grid according IEEE Standard 519-1992.

VI. ACKNOWLEDGMENT

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Amirullah was born in Sampang East Java Indonesis, in 1977. He received bachelor and master degree in electrical engineering from University of Brawijaya Malang and ITS Surabaya, in 2000 and 2008, respectively. He also worked as a lecturer in University of Bhayangkara Surabaya. He is currently working toward the doctoral degree, in electrical engineering in Power System and Simulation Laboratory (PSSL) ITS Surabaya. His research interest includes power system modeling and simulation, power quality, harmonic distortion, design of harmonic filter/power factor correction, and renewable energy.

Ontoseno Penangsang was born in Madiun East Java Indonesia, in 1949. He received bachelor degree in electrical engineering from ITS Surabaya, in 1974. He received M.Sc and Ph.D degree in Power System Analysis from University of Wisconsin, Madison, USA, in 1979 and 1983, respectively. He is currently a professsor at Department of Electrical Engineering and the Head of Power System and Simulation Laboratory (PSSL) ITS Surabaya. He has a long experience and main interest in power system analysis (with renewable energy sources), design of power distribution, power quality, and harmonic migitation in industry.

Adi Soeprijanto was born in Lumajang East Java Indonesia, in 1964. He received bachelor in electrical engineering from ITB Bandung, in 1988. He received master of electrical engineering in control automatic from ITB Bandung. He continued his study to Doctoral Program in Power System Control in Hiroshima University Japan and was finished its in 2001. He is currently a professsor at Department of Electrical Engineering and member of Power System and Simulation Laboratory (PSSL) in ITS Surabaya. His main interest includes power system analysis, power system stability control, and power system dynamic stability. He had already achieved a patent in optimum operation of power system.

APPENDIXS:

Tabel I. Standart of voltage distortion limit depend on IEEE 519-1992 Standart

Bus Voltage on PCC	Individual Voltage Distortion (%)	THD (%)
Under 69 kV	3,0	5,0
69,001 kV to 161 kV	1,5	2,5
Over 161,001 kV	1,0	1,5

Tabel II. Limit of current harmonics current pada general distribution system depend on IEEE 519-1992 Standart

Current Harmonics Distortion Limit (In % from Fundamental Value)						
Individual Harmonics Level (Odd Harmonics)						
I_{sc}/I_L	<11	11≤h<17	17≤h<23	23≤h<35	35≤h	TDD
<20*	4	2	1,5	0,6	0,3	5
20 s/d 50	7	3,5	2,5	1	0,5	8
50 s/d 100	10	4,5	4	1,5	0,7	12
100 s/d 1000	12	5,5	5	2	1	15
>1000	15	7	6	2,5	1,4	20

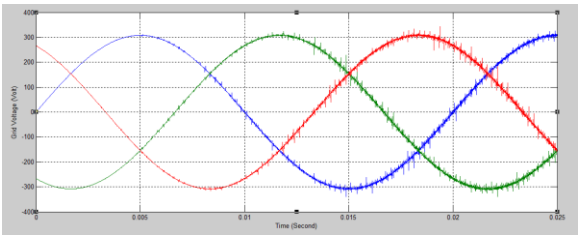
Tabel III. Simulation Parameter

Equipment	Parameters	Value
PV Generator	Power	100 kW
1, 2, and 3	Temperature	40^0 C
	Irradiance	400, 600, 800, dan 1000 W/m^2
Three phase grid	MVA short-circuit	100 MVA
	Voltage (phase-phase)	380 volt
	Frequency	50 Hz
Load 1, 2, 3	Active Power	20 kW
	Voltage	380 Volt
	Frequency	50 Hz
Low voltage line	Resistance	R = 0,1273 Ohm/km
1,2, dan 3	Induktance	L = 93,37 mH/km
	Capasitance	C = 1,274 μF/km
Length of Low Voltage	Line 1	1 km
Distribution Line	Line 2	1 km
	Line 3	1 km
DC Link Kapasitor	Capacitor	2000 μF
PWM Generator	Frequency	4 kHz
For each PV Generator	Sampling time	5 x 10^{-6} detik
Double Tuned Filter	Reactive Power	50 MVAR
Passive	Voltage (phase-phase)	380 V
	Sistem frequency	50 Hz
	Tuning frequency	f_1 = 11 x 50 Hz, f_2 = 13 x 50 Hz
	Quality Factor (Q)	16

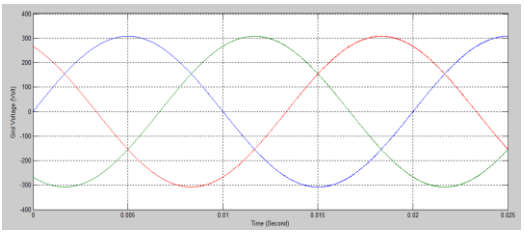
Table IV. Phase voltages and THD voltage grid on three models of integration of PV generator connected to the three phase grid

No.	Irradiance Level (W/m^2)	PV Integration	Voltage-Phase (V)			THD_V			THD_V Avarage (%)
			A	B	C	A	B	C	
	Before using Double Tuned Passive Fiter								
1	400	PV_1	220	220	220	0.54	0.51	0.49	0.52
		$PV_1 + PV_2$	212	212	212	0.91	0.88	0.98	0.93
		$PV_1 + PV_2 + PV_3$	212	212	212	2.68	2.58	2.63	2.62
2	600	PV_1	220	220	220	0.78	0.73	0.65	0.72
		$PV_1 + PV_2$	212	212	212	1.13	1.22	1.39	1.25
		$PV_1 + PV_2 + PV_3$	212	212	212	3.71	3.62	3.54	3.62
3	800	PV_1	220	220	220	0.91	0.86	0.85	0.88
		$PV_1 + PV_2$	212	212	212	1.46	1.54	1.48	1.49
		$PV_1 + PV_2 + PV_3$	212	212	212	4.11	4.17	4.05	4.11
4	1000	PV_1	220	220	220	0.87	0.83	0.78	0.83
		$PV_1 + PV_2$	212	212	212	1.46	1.54	1.59	1.53
		$PV_1 + PV_2 + PV_3$	212	212	212	3.95	3.92	3.84	3.91
	After using Double Tuned Passive Fiter								
1	400	PV_1	220	220	220	0.04	0.03	0.03	0.03
		$PV_1 + PV_2$	220	220	220	0.03	0.03	0.05	0.04
		$PV_1 + PV_2 + PV_3$	220	220	220	0.09	0.10	0.09	0.09
2	600	PV_1	220	220	220	0.05	0.04	0.04	0.04
		$PV_1 + PV_2$	220	220	220	0.05	0.05	0.08	0.06
		$PV_1 + PV_2 + PV_3$	220	220	220	0.19	0.11	0.14	0.15
3	800	PV_1	220	220	220	0.06	0.05	0.06	0.06
		$PV_1 + PV_2$	220	220	220	0.06	0.06	0.10	0.08
		$PV_1 + PV_2 + PV_3$	220	220	220	0.23	0.14	0.18	0.19
4	1000	PV_1	220	220	220	0.05	0.05	0.07	0.06
		$PV_1 + PV_2$	220	220	220	0.06	0.06	0.09	0.07
		$PV_1 + PV_2 + PV_3$	220	220	220	0.22	0.13	0.18	0.18

(a) PV1

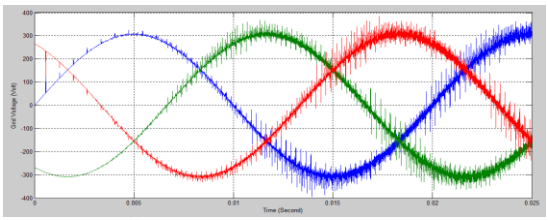


(i) Before Using Filter Passive *Double Tuned*

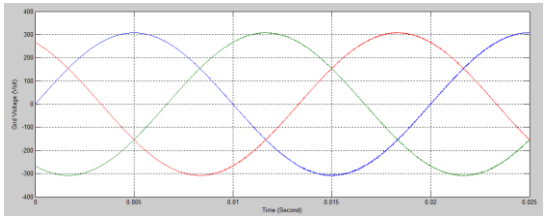


(ii) After Using Filter Passive *Double Tuned*

(b) PV1+PV2+PV3



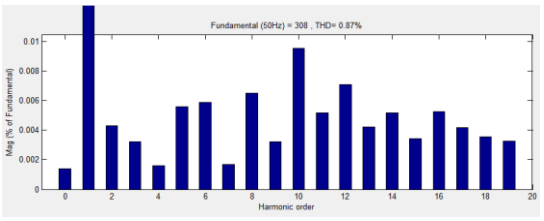
(i) Before Using Filter Passive *Double Tuned*



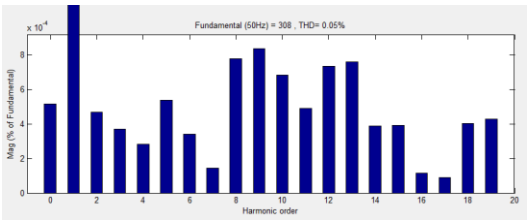
(ii) After Using Filter Passive *Double Tuned*

Figure 7. Simulation results grid voltage on integration of two models of three-phase grid connected PV (solar radiation of 1000 W m2)

(a) PV1

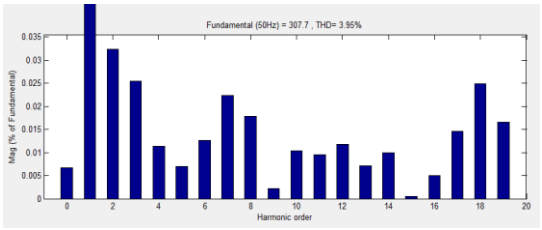


(i) Before Filter Passive *Double Tuned*

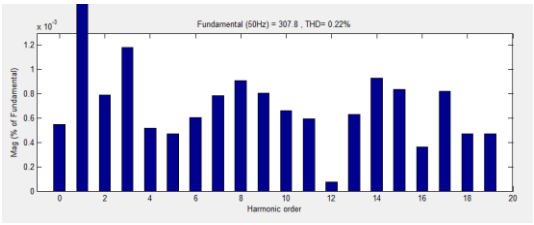


(ii) After Using Filter Passive *Double Tuned*

(b) PV1+PV2+PV3

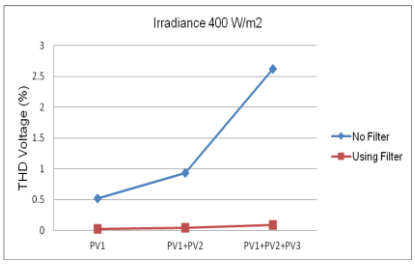


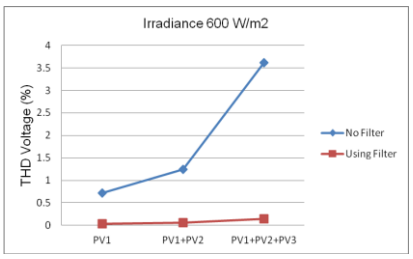
(i) Before Filter Passive *Double Tuned*



(ii) After Using Filter Passive *Double Tuned*

Figure 8. Harmonic spectrum of phase A grid voltage on two models of integration of PV connected grid (solar radiation of 1000 W/m2)





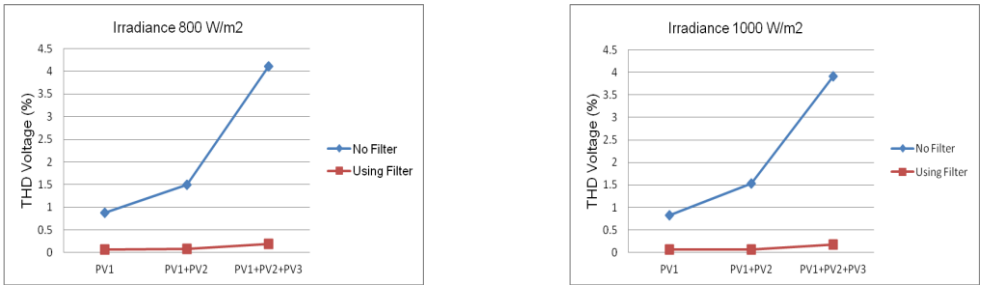
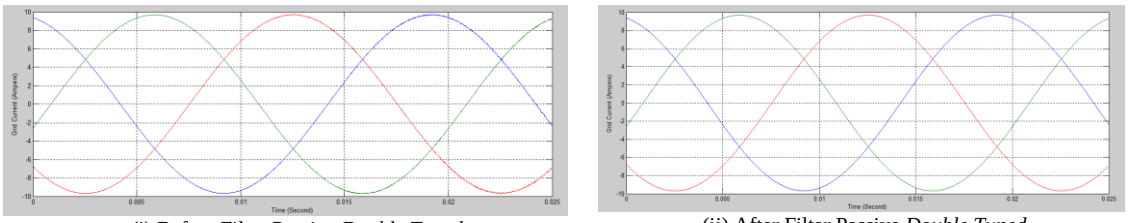


Figure 9. Level of harmonic voltage grid in three models of integration PV connected to three-phase grid (irradiance of 400 to 1000 W/m2)

Table V. Value of phase current and current THD grid on three models of integration of PV generators connected to the three phase grid

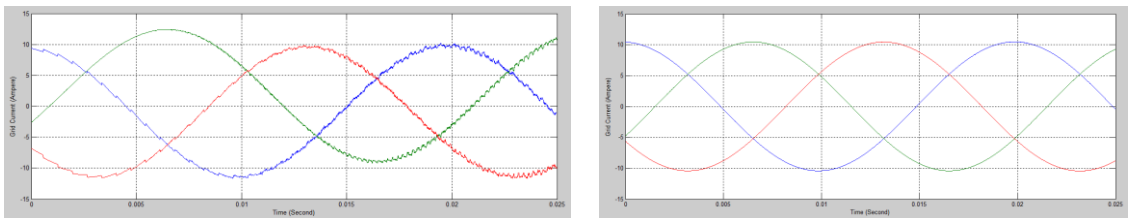
No.	Irradiance Level (W/m^2)	PV Integration	Phase Current (A)			THD_I			THD_I Avarage (%)
			A	B	C	A	B	C	
	Before using Passive *Double Tuned*								
1	400	PV_1	6.8	6.8	6.8	0.07	0.08	0.06	0.07
		$PV_1 + PV_2$	6.8	6.8	6.8	0.24	0.24	0.35	0.28
		$PV_1 + PV_2 + PV_3$	6.8	8.6	6.8	2.10	1.27	1.69	1.69
2	600	PV_1	6.8	6.8	6.8	0.10	0.12	0.10	0.11
		$PV_1 + PV_2$	6.8	6.8	6.8	0.35	0.24	0.39	0.33
		$PV_1 + PV_2 + PV_3$	7.1	9.2	7.1	2.24	1.48	1.83	1.86
3	800	PV_1	6.8	6.8	6.8	0.13	0.13	0.13	0.13
		$PV_1 + PV_2$	6.8	6.8	6.8	0.44	0.30	0.40	0.38
		$PV_1 + PV_2 + PV_3$	7.1	9.2	7.1	2.28	1.56	1.93	1.93
4	1000	PV_1	6.8	6.8	6.8	0.12	0.13	0.14	0.13
		$PV_1 + PV_2$	6.8	6.8	6.8	0.39	0.32	0.41	0.38
		$PV_1 + PV_2 + PV_3$	7.1	9.2	7.1	2.31	1.61	1.85	1.93
	After Using Filter Pasif *Double Tuned*								
1	400	PV_1	6.8	6.8	6.8	0.01	0.00	0.00	0.00
		$PV_1 + PV_2$	6.8	6.8	6.8	0.01	0.01	0.01	0.01
		$PV_1 + PV_2 + PV_3$	7.5	7.5	7.5	0.03	0.02	0.03	0.03
2	600	PV_1	6.8	6.8	6.8	0.01	0.01	0.01	0.01
		$PV_1 + PV_2$	6.8	6.8	6.8	0.01	0.01	0.01	0.01
		$PV_1 + PV_2 + PV_3$	7.5	7.5	7.5	0.04	0.03	0.04	0.04
3	800	PV_1	6.8	6.8	6.8	0.01	0.01	0.01	0.01
		$PV_1 + PV_2$	6.8	6.8	6.8	0.01	0.02	0.02	0.02
		$PV_1 + PV_2 + PV_3$	7.5	7.5	7.5	0.05	0.04	0.06	0.05
4	1000	PV_1	6.8	6.8	6.8	0.01	0.01	0.01	0.01
		$PV_1 + PV_2$	6.8	6.8	6.8	0.01	0.02	0.02	0.02
		$PV_1 + PV_2 + PV_3$	7.5	7.5	7.5	0.07	0.04	0.05	0.05

(a) PV1



(i) Before Filter Passive *Double Tuned* (ii) After Filter Passive *Double Tuned*

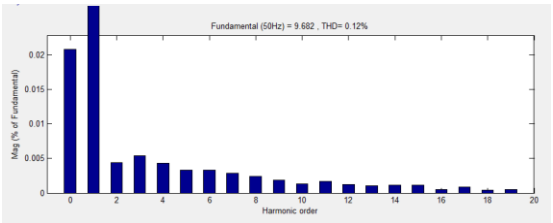
(b) PV1+PV2+PV3



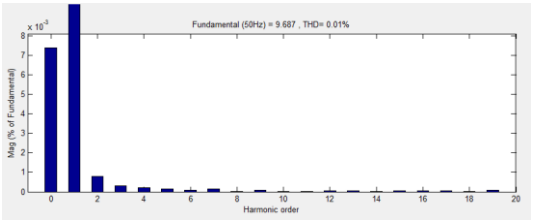
(i) Before Filter Passive *Double Tuned* (ii) After Filter *Double Tuned*

Figure 10. Simulation results grid current on integration of two models of PV connected to three-phase grid (irradiance of 1000 W/m2)

(a) PV1

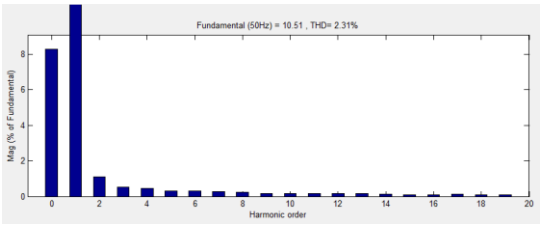


(i) Before Filter Passive *Double Tuned*

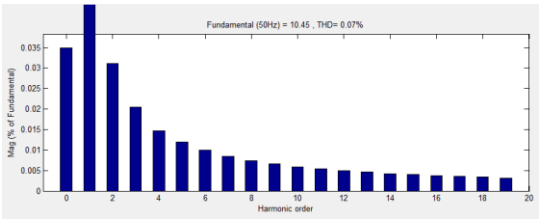


(ii) After Filter Passive *Double Tuned*

(b) PV1+PV2+PV3



(i) Before Filter Passive *Double Tuned*



(ii) After Filter Passive *Double Tuned*

Figure 11. Harmonic spectrum of current phase A grid on two models of integration of PV connected grid (Irradiance of 1000 W/m2)

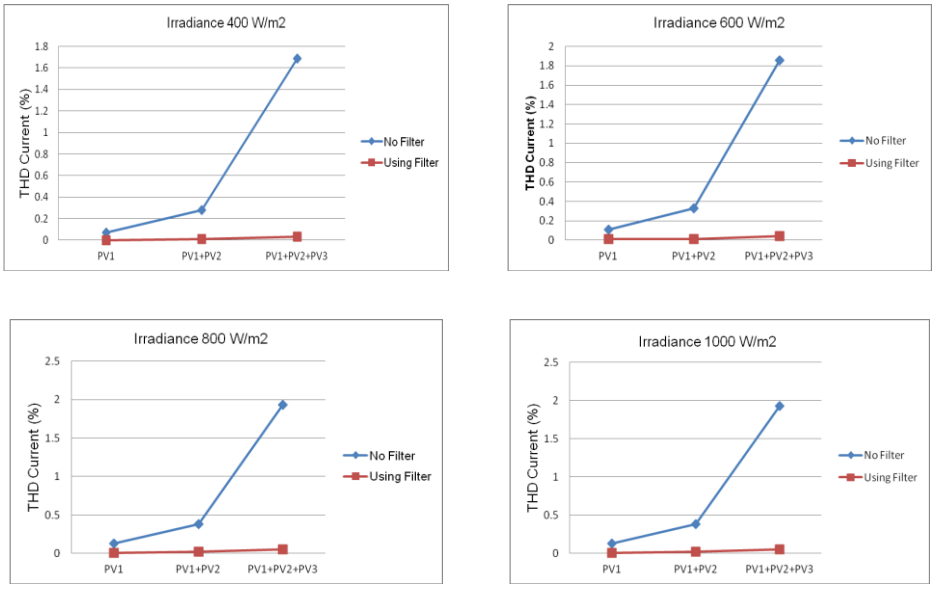


Figure 12. Level of harmonic current grid in three models of integration PV connected to three-phase grid (irradiance of 400 to 1000 W/m2)

Lampiran 2.2

Registration Proof Makalah

International CEIE 2015

UM Malang

INTERNATIONAL CONFERENCE ON ELECTRICAL ENGINEERING, INFORMATICS, AND ITS EDUCATION
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REGISTRATION PROOF

Participant Code : CEIE_1440076572

Paper Code : PAPER_1440090167

Name : Amirullah, ST, MT.

Institution : Sepuluh Nopember Institute of Technology Surabaya

Registered On : 2015-09-17 19:28:29

Detail Registration :

- Register As : Author (Student Master/Doctoral)
- The Attendance : 3 Author (Include Main Author)
- Additional Activity : TELKOMNIKA : International Journal Writing
- Bromo Tour : No

Counter 1	Counter 2	Counter 3	Counter 4

Lampiran 2.3

Bukti Pembayaran Makalah

CEIE 2015 UM Malang

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3579992850 Ibu TRIYANNA WIDIYANINGTYAS IDR 750.000,00
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BRANCH SURABAYA
14-51774

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Nama Alias :-
Alamat Penyetor :-
Informasi Penyetor :Nasabah, No.Rek:-
Berita/Keterangan :-

Pemilik :Ibu TRIYANNA WIDIYANINGTYAS
Rekening Pemilik :0357992850
Debet Rekg/Tunai :TUNAI

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Lampiran 2.4

Schedule Acara

CEIE 2015 UM Malang

SCHEDULE

DISTRIBUTION AUTOMATION WORKSHOP

BY WININDO

Day/Date : Friday, October 2, 2015
Place : H5.211
PIC : Balqish (PTE off A 2015)
Moderator : M. Irham Fadlika, S.T., M.T.
Technician : Fery Hidayatullah Firmansyah S.Pd

Event	Description	Duration	Time
Participant Registration		60 minutes	07.00-08.00
Opening	1) Opening and Praying lead by MC	5 minutes	08.00-08.15
	2) Reading the schedule of workshop Distribution Automation	10 minutes	
WinSMART GRID Presentation	1) Reading the biographical data of speaker	5 minutes	08.15 – 09.00
	2) Presentation by speaker	30 minutes	
	3) Question and answer session	10 minutes	
Training WinREMOTE Protection	1) Presentation by speaker and Question-answer session	30 minutes	09.00 – 10.30
	2) Workshop and Question-answer session	60 minutes	
Basic Training WinSMART GRID	1) Presentation by speaker	20 minutes	10.30 – 11.00
	2) Question and answer session	10 minutes	
Rest		120 minutes	11.00 – 13.00
WinSMART GRID Application	1) Presentation by speaker and Question-answer session	30 minutes	13.00 – 15.30
	2) Workshop and Question-answer session	120 minutes	
Closing	1) The wise words and hope of Workshop Participant	15 minutes	15.30 – 16.00
	2) Delivery of a memento to the speaker	15 minutes	

SCHEDULE
LABVIEW AND MYDAQ WORKSHOP
BY NATIONAL INSTRUMENTS

Day/Date : Friday, October 2, 2015
Place : H5 208
PIC : Riza (PTE off B 2015)
Moderator : Solihul Hadi, S.T., M.Eng
Technician : Firdaus Aslami, A.Md

Event	Description	Duration	Time
Registration of participant session 1	Registration of Participant session 1 workshop NI	60 minutes	07.00-08.00
Opening	1) Opening and Praying lead by MC	5 minutes	08.00-08.15
	2) Reading the schedule of workshop LabVIEW and MyDAQ	10 minutes	
Workshop Session I	1) Presentation by speaker and Question-answer session	30 minutes	08.15 – 10.20
	2) Workshop and Question-answer session	90 minutes	
	3) Closing of workshop session 1	5 minutes	
Rest and Mild Time	There are Coffe Break and lunch for speaker in "korlab timur" room	120 minutes	10.20 – 13.00
Registration of participant session 2	Registration of Participant session 1 workshop NI 2	15 minutes	13.00 – 13.15
Opening	1) Opening and Praying lead by MC	5 minutes	13.15 – 13.30
	2) Reading the schedule of workshop LabVIEW and MyDAQ	10 minutes	
Workshop Session II	1) Presentation by speaker and Question-answer session	30 minutes	13.30 – 15.45
	2) Workshop and Question-answer session	90 minutes	
CLosing	1) The wise words and hope of Workshop Participant	5 minutes	15.45 - 16.00
	2) Delivery of a memento to the speaker	10 minutes	

SCHEDULE
SHARING OF JOURNAL INTERNATIONAL WRITING
BY Mr. TOLE SUTIKNO (CHIEF EDITOR TELKOMNIKA)

Day/Date : Friday, October 2, 2015
Place : H5 207
PIC : Purnianingsih
Moderator : Dr. Muladi, S.T., M.T.
Technician : Fatra Nonggala Putra, S.Pd

Event	Description	Duration	Time
Participant Registration		60 minutes	07.00-08.00
Opening	1) Opening and Praying lead by MC	5 minutes	08.00-08.30
	2) The Speech from chairman of the electrical engineering department	15 minutes	
	3) Reading the schedule of workshop Sharing of Journal International Writing	5 minutes	
Presentation	1) Presentation by speaker and Question-answer session	30 minutes	08.30 – 10.45
	2) Workshop and Question-answer session	75 minutes	
Closing	1) Workshop and Question-answer session	10 minutes	10.45 – 11.00
	2) Praying	5 minutes	

SCHEDULE CEIE 2015

Day : Saturday, Oktober 3rd 2015
Keynote Speaker : 1. Hajime MIAUCHI (Kumamoto University)
2. Hanan Nugroho (Bapenas)
Place : Graha Cakrawala

Event	Description	Duration	Time
Participant Registration	Video Playback 1) Electrical Engineering Department 2) HME 3) WSE 4) Robotic Team 5) Engineering Faculty	60 minutes	07.00-08.00
Opening	1) Dance of Malang Mask	10 minutes	08.00-08.10
Opening Event	1) MC on the stage	5 minutes	08.10-09.30
	2) Singing Indonesia Raya	10 minutes	
	3) The Speech from chief of committee CEIE 2015	15 minutes	
	4) CEIE Videos playback	5 minutes	
	5) The Speech from dean of engineering faculty	15 minutes	
	6) The Speech from rector of Malang State University	15 minutes	
	7) Opening CEIE 2015 by Striking Gong	5 minutes	
Coffee Break	interlude songs by Electrical Engineering Student 1) Tanah airku song 2) Heal the world song	15 minutes	09.30-09.45
Seminar I	1) MC on the stage	5 minutes	09.30-10.30

Keynote : Prof. Hajime MIAUCHI	2) Reading the biographical data of Keynote Speaker by Moderator	5 minutes	
	3) Presentation from Keynote Speaker	30 minutes	
	4) Question and answer session	15 minutes	
	5) Conclusion	5 minutes	
Ice Breaking	MC on the stage Indonesian Culture Song	10 minutes	
Presentation of Keynote: Hanan Nugroho	1) MC on the stage	5 minutes	10.45-12.15
	2) Reading the biographical data of Speaker by Moderator	5 minutes	
	3) Presentation from Speaker	30 minutes	
	4) Question and answer session	30 minutes	
	5) Conclusion	5 minutes	
Announcement	Reading of Announcement by MC	15 minutes	12.15-12.30
Rest and Mild Time	1) Lunch	20 minutes	12.30-13.30
	2) Moving in front of Graha Cakrawa	5 minutes	
	3) Moving to the mosque	15 minutes	
	4) Sholat	15 minutes	
	5) Moving to H5 Building	5 minutes	

PARARELL SESSION

2nd floor dan 3rd floor, Faculty of Engineering

Event	Description	Duration	Time
Opening Parallel Session	Opening parallel session by room coordinator	5 minutes	13.30-13.45

Presentation	Author 1	75 minutes	13.45-15.00
	Author 2		
	Author 3		
	Author 4		
	Author 5		
Coffee Break	Rest and Mild Time	30 minutes	15.00-15.30
Presentation	Author 6	75 minutes	15.30 – 16.45
	Author 7		
	Author 8		
	Author 9		
	Author 10		
Closing	Closing parallel session by room coordinator	10 minutes	16.45 – 17.00
	Certificate Distribution	5 minutes	

Lampiran 2.5

Sertifikat Pemakalah

di Seminar Internasional

CEIE 2015 UM Malang

Number : 2.10.23/UN32.5/DT/2015

Certificate of Participation

Awarded to

Amirullah

who has participated on
International Conference on Electrical Engineering, Informatics,
and Its Education (CEIE) 2015
"GreenTechnology and It's Education for Providing Sustainable Energy"
as

Author

on October 3 - 4 2015
State University of Malang

Malang, October 2nd, 2015
General Chair of The Committee

Dr. Eng Siti Sendari ST., MT.
NIP 19740402 199802 2 001

Dean of The Faculty of Engineering,

Dr. H. Andoko, ST., M.T.
NIP 19650812 199103 1 005

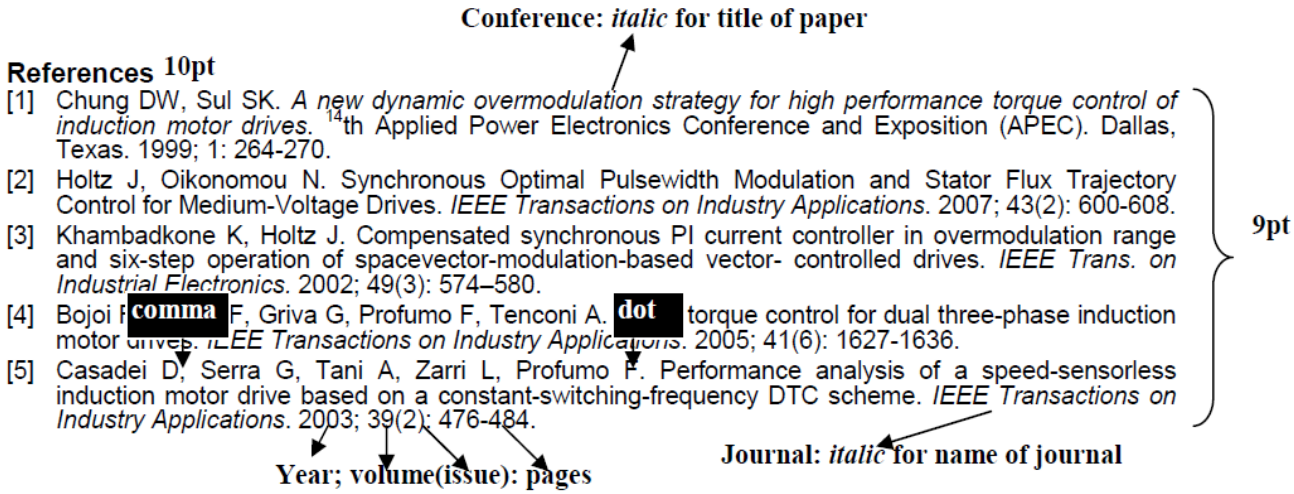
Lampiran 2.6

Cek List Publikasi Makalah

di Jurnal TELKOMNIKA

Checklist for Final Papers

1. Is your manuscript written in TELKOMNIKA format? At this stage, it is not that essential that you follow every detail of TELKOMNIKA format. Please try to follow the format as closely as possible.
2. Is your title adequate and is your abstract correctly written? The title of paper is max 10 words, without Acronym or abbreviation. The Abstract (MAX 200 WORDS) should be informative and completely **self-explanatory** **(no citation in abstract)**, provide a clear statement of the **problem**, the **proposed** approach or solution, and point out **major findings** and conclusions.
3. Authors are suggested to present their articles in the section structure**: Introduction - The Proposed Method/Algorithm (optional) - Research Method - Results and Discussion – Conclusion.**
4. The author is also suggested to describe the real problem existing (to be listed in the References) in "introduction section" in order to satisfy the criteria of this scientific journal which has to introduce any novelties, improvement etc from the research work prior to the problem solving done or proposed by the author as a significant contribution. This critical point is available in the guideline for the author provided by the Editor.
5. The results of research and analysis are NOT incisively provided in the paper. You should improve your analyzing and also present the comparison between performance of your approach and other researches. It is very important to prove that your manuscript has a significant value and not trivial.
6. Please be sure that the manuscript is up to date. **It is expected that 10 to 20% of references are to recent papers.**
7. What is a likelihood of citation of your manuscript? Please notice that very soon your technical accomplishments will be evaluated based on the number of citations but not based on the number of papers published. Therefore, your paper should very clearly describe your accomplishments so other people can understand what is your original contribution.
8. Is the manuscript clearly written? Is the article exciting? Does the content flow well from one section to another? Please try to keep your manuscript on the proper level. It should be easy to understand by well qualified professionals, but at the same time please avoid describing well known facts (use proper references instead). Often manuscripts receive negative reviews because reviewers are not able to understand the manuscript and this is authors' (not reviewers') fault. Notice, that if reviewers have difficulties, then other readers will face the same problem and there is no reason to publish the manuscript.
9. Do you have enough references? We will usually expect a minimum of 10 to 25 references primarily to journal papers, depending on the length of the paper. Citations of textbooks should be used very rarely and citations to web pages should be avoided. All cited papers should be referenced within the text of the manuscript.
10. Each citation should be written **in the order of appearance in the text.**
11. **How to write your references**



12. The references should be integrated also with **not less than two papers published on TELKOMNIKA**

Please be aware that for the final submission of regular paper you will be asked to tailor your paper so the last page is not half empty.

Lampiran 2.7

Makalah Penulis di

CEIE 2015 UM Malang

Masuk *Selected Paper*

untuk Dipublikasikan

di Jurnal TELKOMNIKA

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DOI: 10.12928/TELKOMNIKA.v13i1.xxxx

Power Quality Analysis of Integration Photovoltaic Generator to Three Phase Grid under Variable Solar Irradiance Level

Amirullah[1,4], Ontoseno Penangsang[2], Adi Soeprijanto[3]
[1,2,3]Electrical Engineering Department, Industrial Technology Faculty,
Kampus Institut Teknologi Sepuluh Nopember (ITS) Sukolilo Surabaya Indonesia
Jl. Arief Rahman Hakim Surabaya Indonesia 60111 Ph/Fax: +62-31-594 7302/+62-31-593 1237
[4]Electrical Engineering Study Program, Engineering Faculty,
University of Bhayangkara Surabaya
Jl. Ahmad Yani 114 Surabaya Indonesia, Ph/Fax: +62-31-8285602/+62-31-8285601
amirullah14@mhs.ee.its.ac.id[1,4], am9520012003@yahoo.com[1,4]
Zenno_379@yahoo.com[2], adisup@ee.its.ac.id[3]

Abstract

Objective of research is to analyze the influence of solar irradiance and integration of photovoltaic (PV) generator to power quality of three phase grid on the constant temperature and load, based on changes in some level of integration of PV generator. Power quality aspects studied are fluctuation or changing, and harmonics of voltage and current on eight scenarios PV generator connected to three-phase grid, using passive filter circuit model double band pass (double tuned). Research shows that voltage and current values on the PCC bus before use double tuned passive filter on the condition only connect single generator is still stable. However, if the PV generator connected to the three phase grid, amounted to more than one generation, voltage and current grid becomes unstable (fluctuation). At the level of solar radiation remains, the greater number of PV generators connected to the grid three-phase, then the values of voltage and current THD increases. At the level of solar irradiance increases, average THD of voltage and current grid also increased. Avarage THD of voltage and current grid is reduced after double tuned passive filter installed. Therefore, double tuned passive filter able to improve profile of voltage and current THD grid as a result of the integration of a number of PV power generators in three-phase grid according IEEE Standard 519-1992. Simulation and analysis of this research use Matlab/Simulink.

Keywords: Power Quality, Total Harmonic Distortion, Photovoltaic Generator, Grid, Irradiance

1. Introduction

Among the renewable energy resources, the energy due to the photovoltaic (PV) effect can be considered as the most important resource because it can be installed in any location, abundant energy, and produces sustainable solar irradiance energy. Despite of discontinuous nature of sunlight, solar energy is widely available and is free. Application of PV as a electrical energy source shows increasing trend both in the implementation of spead area over the world and installed capacity of power generator. The trend is triggered by many factors such as the increasing of fossil fuels cost, declination of production costs per kW from PV, and also development of solar cell technologies that cause the PV power conversion more efficient. PV module represents the fundamental power conversion unit of PV generator system. The output of PV charactheristic module depends on solar irradiance, cell temperature, and output voltage of the PV module. Since PV module has a nonlinear characteristics, it is necessary to model it for the design and simulation maximum power point tracking (MPPT) for PV system applications. PV generation system can either be operated in an isolated system or connected to the grid to form an integrated system, and with sources of renewable electrical energy can form distributed renewable energy generation. One aspect of the inclusion of PV as part of distributed generation is the power quality generated from their operation for example voltage unbalance (fluctuation), voltage and current harmonics. A study to model and simulate residential grid connected solar photovoltaic system have been discussed. Mathematical modeling and simulation of PV generation systems has been conducted to determine the I-V, P-I, P-V characteristics [1]. Research of design and implementation of PV-based three phase four-wire series hybrid active power filter for power quality improvement have been conducted. This paper proposes a PV based three phase four wire Series Hybrid Active Power Filter arranged by Series Active Power Filter and an LC shunt passive filter. The proposed model eliminates

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both the current and voltage harmonics and compensates reactive power, neutral current, and voltage interruption [2]. A study of power quality analysis of photovoltaic generation integrated in user grid. This paper analyzes impact of grid-connected photovoltaic power plant on harmonic in the power quality aspect of distribution network [3]. The weakness of three studies are number of PV generator used only a single PV generation and connected to single phase grid, so that current and voltage harmonics generated due to the presence of the inverter in PV generating system is not very significant.

Research to assess the impact of integration of a number of the PV generator to power quality at different solar irradiation level and daily load consumption based on changes in the level of PV integration is already done. The disadvantage is a PV generator that is used only to connect to single phase grid and harmonic analysis is only performed on the harmonic voltage [4]. Research on the effects of installation of PV generator to power quality in three phase industrial and residential distribution network has been discussed. However, PV generator which installed is still static which is based on level of solar irradiance, temperature, and current and voltage harmonic generated by PV generator with a fixed value [5]. Objective of research is to analyze the influence of solar irradiance and integration of PV generator to power quality of three phase grid on the constant temperature and load, based on changes in some level of integration of PV generator. Power quality aspects studied are fluctuation or changing, and harmonics of voltage and current on eight scenarios PV generator connected to three-phase grid. The rest of this paper is organized as follow. Section 2 shows proposed model of single and three PV generator system connected to three-phase grid, power quality and harmonic, photovoltaic system, mathematical model of PV cell and panel, and shunt passive filter. Section 3 describes influence of solar irradiance and integration of PV generator to voltage, current, voltage and current Total Harmonic Distortion (THD) of three phase grid on the constant temperature and load, based on changes in some level of integration of PV generator. In this section. example cases studied are presented and the results are verified with those of Matlab/Simulink. Finally, the paper in concluded in Section 4.

2. Proposed Model of PV Generator System Connected to Three Phase Grid

Figure 1 shows a model of a single PV power system connected three phase grid [6]. The series of DC/DC converter consists of a boost converter circuit that functions to raise the voltage of the DC output of the PV generator. DC output voltage of the boost converter circuit is then converted by the DC/AC inverter into a three-phase AC voltage to the three-phase grid. Single PV generator model is then used as a reference to create a model for many (multi) PV generators connected to the grid via a three-phase distribution transformer (Figure 1). The study used three groups of models of PV generators with the active power of 100 kW each. Besides connecting the three-phase grid, the PV generator is also connected to the three groups of three phase load with active power 20 kW respectively. The objective of research is to analyze the influence of solar irradiance and integration of photovoltaic (PV) generator to power quality of three phase grid on the constant temperature and load, based on changes in some level of integration of PV generator. Power quality aspects studied is the fluctuation, and harmonics of voltage and current on eight scenarios PV generator connected to three phase grid, as follow:

1. Before double tuned passive filter installed
   a. Irradiance 400 W/m^2 on the condition 1, 2, and 3 of model PV generator connected to three phase grid.
   b. Irradiance 600 W/m^2 on the condition 1, 2, and 3 of model PV generator connected to three phase grid.
   c. Irradiance 800 W/m^2 on the condition 1, 2, and 3 of model PV generator connected to three phase grid.
   d. Irradiance 1000 W/m^2 on the condition 1, 2, and 3 of model PV generator connected to three phase grid.

2. After double tuned passive filter installed
   a. Irradiance 400 W/m^2 on the condition 1, 2, and 3 of model PV generator connected to three phase grid.
   b. Irradiance 600 W/m^2 on the condition 1, 2, and 3 of model PV generator connected to three phase grid.
   c. Irradiance 800 W/m^2 on the condition 1, 2, and 3 of model PV generator connected to three phase grid.

d. Irradiance 1000 W/m^2 on the condition 1, 2, and 3 of model PV generator connected to three phase grid.

The model of passive filter circuit is a double band pass (double tuned). The circuit model simulations conducted to determine the voltage and current curves of three phase grid. There are two scenarios simulations done that before and after the double tuned passive filter installed. Wherein each consisting of four scenarios for a total of eight scenarios integration of PV generators. The next stage is to determine the value of voltage and current THD on each scenario grid. The final step is to compare the value of voltage, current, voltage and current THD grid on point common coupling (PCC) bus refers to the IEEE Standard 519-1992. This standart is the basis for determining level of power quality at the eight scenarios radiation levels and integration of grid connected PV generator model three phase. Simulation and analysis of this research use Matlab/Simulink.

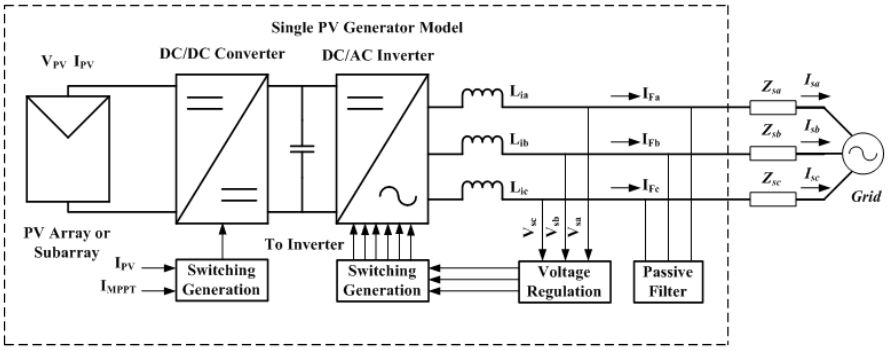


Figure 1. Model of single PV generator system connected to three phase grid

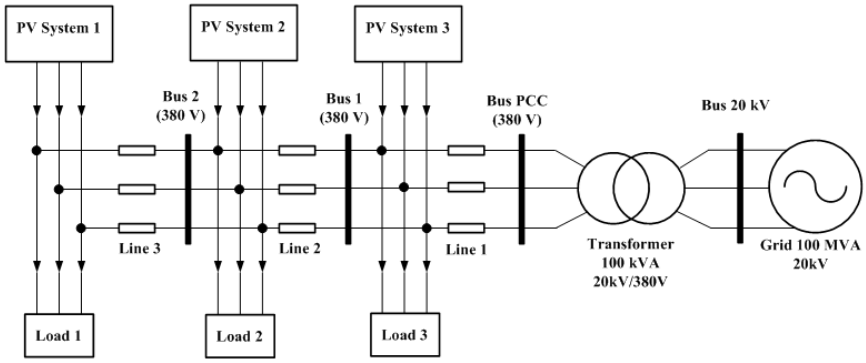


Figure 2. Proposed model of three PV generator system connected to three phase grid

2.1. Power Quality and Harmonic

Power quality means the quality of voltage and current. Voltage and current quality is determined based on the value or the tolerance limit of the equipment used. In general, current and voltage wave form of the pure sinusoidal waveform. One problem that arises is the wave of current and voltage is not sinusoidal or defects caused by the emergence of harmonics generated by the power system [7]. The term used to describe deviations harmonics sinusoidal wave associated with the current and voltage of different amplitude and frequency. Changes in current and voltage waveforms caused by harmonics will disrupt the electrical distribution system and lower the quality of the system power. In the electric power system, definition of harmonics can be described as a distorted periodic waveform at steady state are caused by the interaction between the shape of a sine wave at the fundamental frequency system with another wave components which are integer multiples of the frequency of the fundamental frequency sources. Figure 1 shows the signal waveform distortion due to harmonics.

Harmonic distortion explained through several key parameters to describe the effects of harmonics on power system components. The first parameter is Total Harmonic Distortion (THD). THD is the ratio of the rms value of harmonic components to the rms value of the fundamental component and is commonly expressed in percent (%). This index is used to measure deviations periodic waveforms containing harmonics of a perfect sine wave [7]. On a perfect sine wave THD value is zero percent. Voltage THD value is expressed in Equation 1.

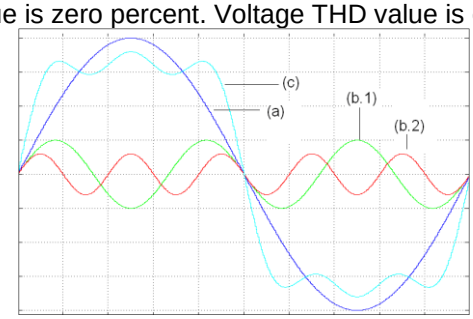


Figure 3. Distorted Wave resulted by Harmonics. Description: a = wave at the fundamental frequency, b.1 = 3rd harmonic wave, b.2 = wave harmonics 5th, c. = Distorted Wave

$$THD_V = \frac{\sqrt{\sum_{n=2}^{k} U_n^2}}{U_1} \times 100\ \% \quad (1)$$

Description: U_n = harmonic component; U_1 = the fundamental component; K = maximum harmonic components

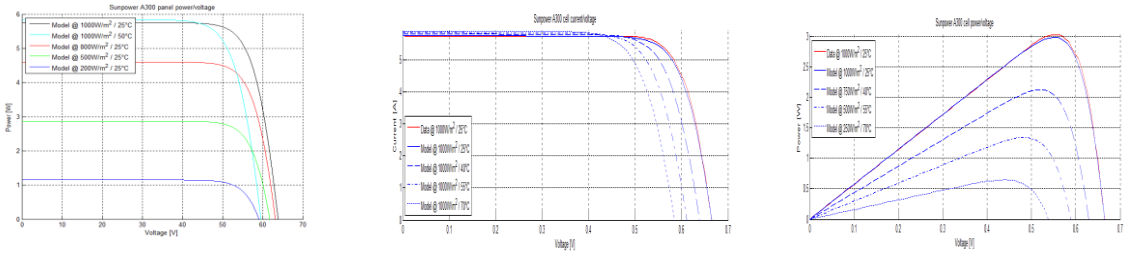
The second parameter is the Individual Harmonic Distortion (IHD) is the ratio of rms value of individual harmonics to rms value of the fundamental component. The third parameter is the Total Demand Distortion (TDD) or THD_I is amount of current harmonic distortion and defined in the following equation [7]:

$$THD_I = \frac{\sqrt{\sum_{n=2}^{k} I_n^2}}{I_L} \times 100\ \% \quad (2)$$

Where I_L is the maximum load current (for 15 or 30 minutes) at the fundamental frequency at the PCC, calculated from the average current of the maximum load of 12 months earlier. THD value of the maximum allowable for each country is different depending on the standard used. THD standards most often used in electric power system is the IEEE Standard 519-1992 [8]. There are two criteria that are used in the analysis of harmonic distortion that limits voltage distortion and current distortion limits.

2.2. Photovoltaic System

The working principle of PV panel is almost same as diode semiconductor devices. When sunlight reaches the surface of the solar panel, then the photons with a certain energy level will be absorbed, thus freeing electrons from their atomic bonds and the flow of electric current. The solar panels generate the current that varies depending on the voltage of the solar panel. Current-voltage characteristics show the relationship. When the voltage of the solar panel is equal to zero, short circuit current (I_{SC}), which is proportional to the amount of solar radiation on the solar panel can be measured. I_{SC} value rises with increasing temperature, although the standard temperature recorded for the short circuit current is 25^0 C. If the current solar panel is equal to zero, the solar panel is described as an open circuit. The voltage on open circuit or open-circuit voltage (V_{OC}), depending on the amount of solar radiation. This dependence is logarithmic, and decline more rapidly with increased temperatures exceeding the speed increase in I_{sc}. The maximum power of solar panels and solar panel efficiency will decrease with increasing temperature. Solar panels, increasing the temperature of 25^0C resulted in a decrease of about 10% power. Figure 4 shows the curve of the PV panel karakteristisk [9].



(a) I-V Curve on fixed temperature and irradiance change

(b) I-V curve on fixed irradiance and temperature change

(c) P-V curve on temperature change

Figure 4. Characteristic Curve of Panel PV (Tipe MSX-60)

2.3. Mathematical Model of PV Cell and Panel

PV cell equivalent circuit shown in Figure 5 [6] consists of a power supply and a diode. Current photo (I_{ph}) depending on solar radiation (G), and temperature (T) environment.

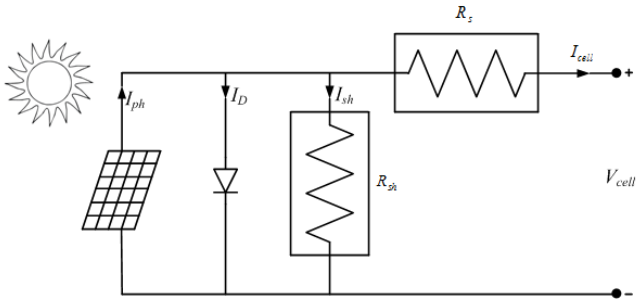


Figure 5. Equivalent Circuit of PV Cell

The conditions described in the Equation 3. I_{ph} (Tref) is the photo stream at a nominal temperature T_{ref}. On the other hand, Equation 4 gives the formula of photo current at a nominal temperature K_0 is a constant that is expressed in Equation 5. G_{ref} and I_{sc} respectively nominal radiation provided by the factory short-circuit current. This equation refer to Figure 2 for a single PV cell [6].

$$I_{ph} = I_{ph}(T_{ref}) \times \left(1 + K_0(T - T_{ref})\right) \quad (3)$$

$$I_{ph}(T_{ref}) = \frac{G}{G_{ref}} \times I_{sc}(T_{ref}) \quad (4)$$

$$K_0 = \frac{I_{sc}(T) - I_{sc}(T_{ref})}{T - T_{ref}} \quad (5)$$

Taking into account that the environment temperature is set at a certain nominal value, then the next PV flow only depends on solar irradiace expressed in Equation 6.

$$I_{ph} = I_{ph}(T_{ref}) = \frac{G}{G_{ref}} \times I_{sc}(T_{ref}) \quad (6)$$

Characteristics of diode current (I_D) is expressed in Equation 7, where the value of saturation current I_O is a diode, where V_T represents the thermal voltage.

$$I_D = \left(I_o e^{V_D / V_T} - 1 \right) \quad (7)$$

Where; $V_D = V_{cell} + (I_{cell} \times R_s)$

Furthermore, by using the Kirchoff Law, shunt current I_{sh} is defined in the following equation:

$$I_{sh} = \frac{V_D}{R_{sh}} \quad (8)$$

By calculating Equation 3 and 8, and applying current Kirchoff's Law, I-V characteristics PV shown in Equation 9.

$$I_{cell} = I_{ph} - I_D - I_{sh}$$

$$I_{cell} = I_{ph} - \left(I_o e^{V_D / V_T} - 1 \right) - \left(\frac{V_D}{R_{sh}} \right) \quad (9)$$

2.4. Shunt Passive Filter

Shunt passive filter technique is one of the most widely used method to mitigate or reduce harmonics on the power grid. Besides reducing passive harmonic filter can be used for optimization of reactive power into the power grid. This equipment consists of passive elements such as resistors, capacitors and inductors. This filter is permanent and once installed they become part of the network and need to be redesigned to obtain different filter frequencies. Passive filter is still considered the best in the network system of three-phase four-wire. The majority of them are low-pass filter that is tuned to the desired frequency. Shunt filter using passive components and offer better harmonics reduction, especially in the harmonic 3, 5, and 7. Some models include a passive filter are band pass filter (single atau double tuned), high pass filters (first, second, third-order or C-type), and composite filter [10]. Figure 6 shows models of passive filter [11].

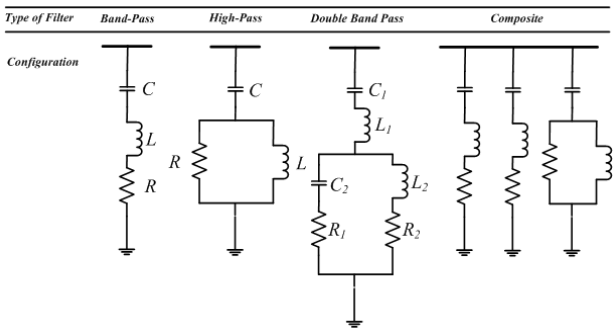


Figure 6. Models of Passive Filter

3. Result dan Discussion

Table 1 shows the equipment, parameters, and values of simulation integration of the three models of PV generators connected to the three phase grid.

Tabel 1. Simulation Parameter

Equipment	Parameters	Value
PV Generator	Power	100 kW
1, 2, and 3	Temperature	40^0 C
	Irradiance	400, 600, 800, dan 1000 W/m^2
Three phase grid	MVA short-circuit	100 MVA
	Voltage (phase-phase)	380 volt
	Frequency	50 Hz
Load 1, 2, 3	Active Power	20 kW
	Voltage	380 Volt
	Frequency	50 Hz
Low voltage line	Resistance	R = 0,1273 Ohm/km
1,2, dan 3	Induktance	L = 93,37 mH/km
	Capasitance	C = 1,274 µF/km
Length of Low Voltage	Line 1	1 km
Distribution Line	Line 2	1 km
	Line 3	1 km
DC Link Kapasitor	Capacitor	2000 µF
PWM Generator	Frequency	4 kHz
For each PV Generator	Sampling time	5 x 10^{-6} detik
Double Tuned Filter	Reactive Power	50 MVAR
Passive	Voltage (phase-phase)	380 V
	Sistem frequency	50 Hz
	Tuning frequency	f_1 = 11 x 50 Hz, f_2 = 13 x 50 Hz
	Quality Factor (Q)	16

Table 2 and 3 respectively shows the nominal of phase and average harmonic voltage (THD_V) grid as well as phase and harmonic current (THD_I) grid in three models of integration of PV generators and four different levels of irradiance connected to three phase grid before and after using double tuned passive filter.

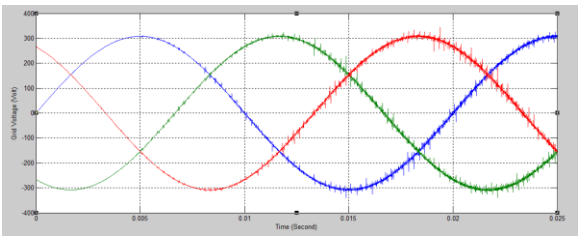
Table 2. Nominal of phase and average voltage harmonic (THD_V) grid on three models of integration of PV generator connected to the three phase grid

No.	Irradiance (W/m^2)	PV Integration	Phase Voltage (V) A	B	C	THD_V A	B	C	THD_V Avarage (%)
Before using Double Tuned Passive Fiter									
1	400	PV_1	220	220	220	0.54	0.51	0.49	0.52
		$PV_1 + PV_2$	212	212	212	0.91	0.88	0.98	0.93
		$PV_1 + PV_2 + PV_3$	212	212	212	2.68	2.58	2.63	2.62
2	600	PV_1	220	220	220	0.78	0.73	0.65	0.72
		$PV_1 + PV_2$	212	212	212	1.13	1.22	1.39	1.25
		$PV_1 + PV_2 + PV_3$	212	212	212	3.71	3.62	3.54	3.62
3	800	PV_1	220	220	220	0.91	0.86	0.85	0.88
		$PV_1 + PV_2$	212	212	212	1.46	1.54	1.48	1.49
		$PV_1 + PV_2 + PV_3$	212	212	212	4.11	4.17	4.05	4.11
4	1000	PV_1	220	220	220	0.87	0.83	0.78	0.83
		$PV_1 + PV_2$	212	212	212	1.46	1.54	1.59	1.53
		$PV_1 + PV_2 + PV_3$	212	212	212	3.95	3.92	3.84	3.91
After using Double Tuned Passive Fiter									
1	400	PV_1	220	220	220	0.04	0.03	0.03	0.03
		$PV_1 + PV_2$	220	220	220	0.03	0.03	0.05	0.04
		$PV_1 + PV_2 + PV_3$	220	220	220	0.09	0.10	0.09	0.09
2	600	PV_1	220	220	220	0.05	0.04	0.04	0.04
		$PV_1 + PV_2$	220	220	220	0.05	0.05	0.08	0.06
		$PV_1 + PV_2 + PV_3$	220	220	220	0.19	0.11	0.14	0.15
3	800	PV_1	220	220	220	0.06	0.05	0.06	0.06
		$PV_1 + PV_2$	220	220	220	0.06	0.06	0.10	0.08
		$PV_1 + PV_2 + PV_3$	220	220	220	0.23	0.14	0.18	0.19
4	1000	PV_1	220	220	220	0.05	0.05	0.07	0.06
		$PV_1 + PV_2$	220	220	220	0.06	0.06	0.09	0.07
		$PV_1 + PV_2 + PV_3$	220	220	220	0.22	0.13	0.18	0.18

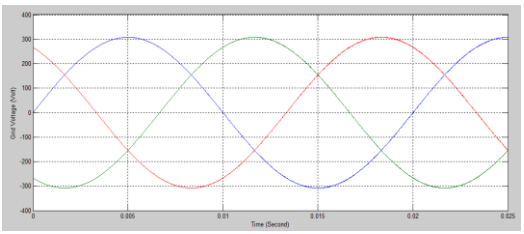
Table 3. Nominal of phase and average current harmonic (THD_I) grid on three models of integration of PV generators connected to the three phase grid

No.	Irradiance (W/m^2)	PV Integration	Phase Current (A) A	B	C	THD_I A	B	C	THD_I Avarage (%)
Before using Passive *Double Tuned*									
1	400	PV_1	6.8	6.8	6.8	0.07	0.08	0.06	0.07
		$PV_1 + PV_2$	6.8	6.8	6.8	0.24	0.24	0.35	0.28
		$PV_1 + PV_2 + PV_3$	6.8	8.6	6.8	2.10	1.27	1.69	1.69
2	600	PV_1	6.8	6.8	6.8	0.10	0.12	0.10	0.11
		$PV_1 + PV_2$	6.8	6.8	6.8	0.35	0.24	0.39	0.33
		$PV_1 + PV_2 + PV_3$	7.1	9.2	7.1	2.24	1.48	1.83	1.86
3	800	PV_1	6.8	6.8	6.8	0.13	0.13	0.13	0.13
		$PV_1 + PV_2$	6.8	6.8	6.8	0.44	0.30	0.40	0.38
		$PV_1 + PV_2 + PV_3$	7.1	9.2	7.1	2.28	1.56	1.93	1.93
4	1000	PV_1	6.8	6.8	6.8	0.12	0.13	0.14	0.13
		$PV_1 + PV_2$	6.8	6.8	6.8	0.39	0.32	0.41	0.38
		$PV_1 + PV_2 + PV_3$	7.1	9.2	7.1	2.31	1.61	1.85	1.93
After Using Filter Pasif *Double Tuned*									
1	400	PV_1	6.8	6.8	6.8	0.01	0.00	0.00	0.00
		$PV_1 + PV_2$	6.8	6.8	6.8	0.01	0.01	0.01	0.01
		$PV_1 + PV_2 + PV_3$	7.5	7.5	7.5	0.03	0.02	0.03	0.03
2	600	PV_1	6.8	6.8	6.8	0.01	0.01	0.01	0.01
		$PV_1 + PV_2$	6.8	6.8	6.8	0.01	0.01	0.01	0.01
		$PV_1 + PV_2 + PV_3$	7.5	7.5	7.5	0.04	0.03	0.04	0.04
3	800	PV_1	6.8	6.8	6.8	0.01	0.01	0.01	0.01
		$PV_1 + PV_2$	6.8	6.8	6.8	0.01	0.02	0.02	0.02
		$PV_1 + PV_2 + PV_3$	7.5	7.5	7.5	0.05	0.04	0.06	0.05
4	1000	PV_1	6.8	6.8	6.8	0.01	0.01	0.01	0.01
		$PV_1 + PV_2$	6.8	6.8	6.8	0.01	0.02	0.02	0.02
		$PV_1 + PV_2 + PV_3$	7.5	7.5	7.5	0.07	0.04	0.05	0.05

Figure 7 shows the curve of grid voltage on two models of integration of PV generators connected to the grid three-phase (solar radiation of 1000 W / m2) on the bus point of common coupling (PCC) (i) without the passive filter and (ii) use double tuned passive filter.

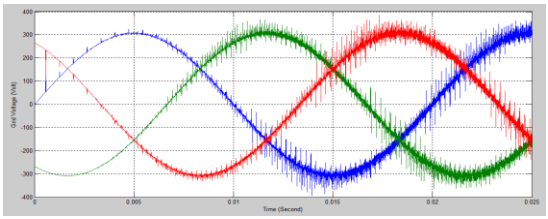


(i) Before Using Filter Passive *Double Tuned*

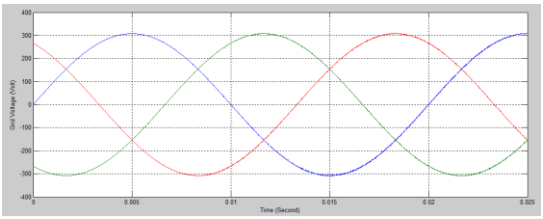


(ii) After Using Filter Passive *Double Tuned*

(a) PV1+PV2+PV3



(i) Before Using Filter Passive *Double Tuned*

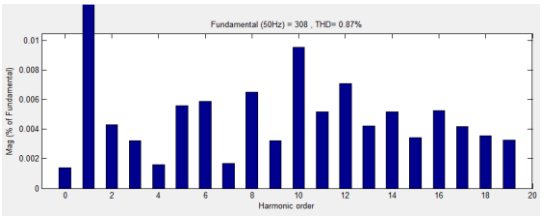


(ii) After Using Filter Passive *Double Tuned*

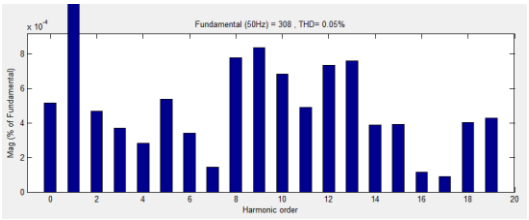
Figure 7. Simulation results grid voltage on integration of two models of three-phase grid connected PV under solar irradiance level of 1000 W m2

Figure 8 shows the spectrum of harmonics voltage grid at phase A in two models of integration of PV generator connected to the three-phase grid under solar irradiance level of 1000 W/m2 on the PCC bus (i) before and (ii) after using passive filters double tuned.

(a) PV1

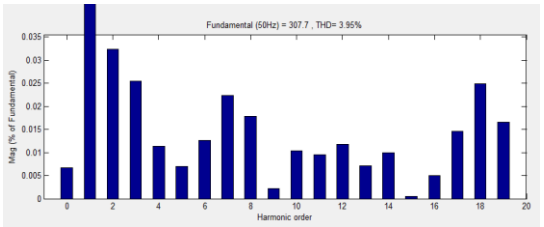


(i) Before Filter Passive *Double Tuned*

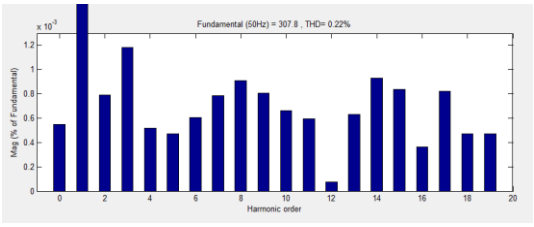


(ii) After Using Filter Passive *Double Tuned*

(b) PV1+PV2+PV3



(i) Before Filter Passive *Double Tuned*



(ii) After Using Filter Passive *Double Tuned*

Figure 8. Harmonic spectrum of phase A grid voltage on two models of integration of PV connected grid under solar irradiation of 1000 W/m2

Figure 9 shows curve of average harmonic of voltage grid (THD_V) on three models of integration of generation PV and four levels of solar irradiance connected to the three-phase grid on PCC bus (i) before and (ii) after using double tuned passive filter.

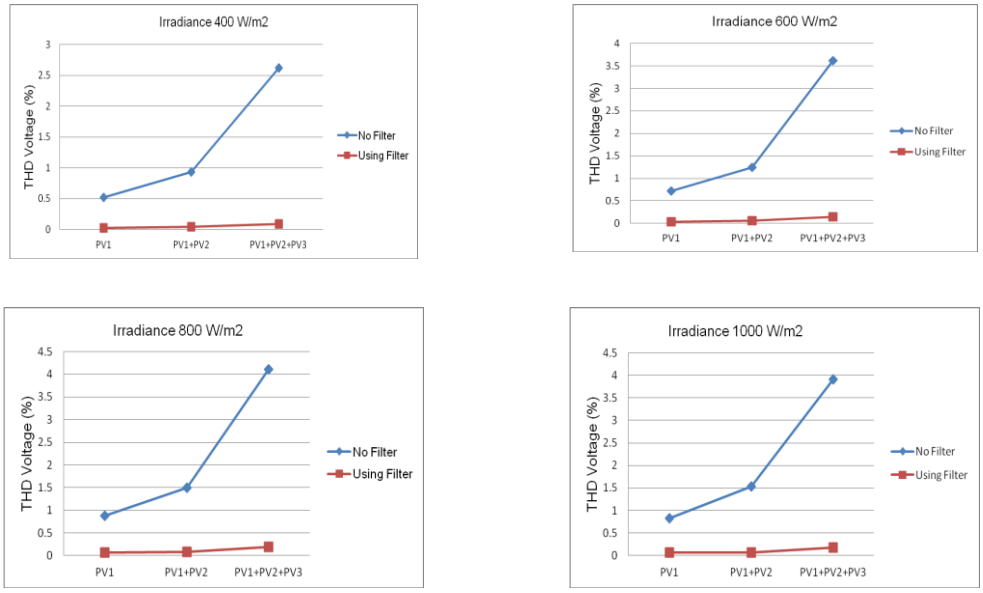


Figure 9. Avarage harmonic of voltage grid in three models of integration PV connected to three phase grid under solar irradiance level of 400 to 1000 W/m2

Table 2 shows that the value of the grid voltage before use double tuned passive filter on the condition only connect one generator (PV1) remained stable (220 Volt). However, if the PV generator connected to the grid three-phase, amounted to more than one generation (PV1+PV2 and PV1+PV2+PV3), grid voltage at PCC bus decrease to 212 Volt or 3.36%. After using double tuned passive filter, grid voltage of PV generator integration at all levels (PV1, PV2 + PV1, and PV1+PV2+PV3) value becomes stable (220 Volt). Without double tuned passive filter, the largest THD average of grid voltage is generated on the condition of all PV generators connected to the three phase grid (PV1 + PV2 + PV3) and the irradiance level of 800 W/m2 at 4.11%. The smallest value of average grid voltage THD is produced on the condition of only single PV generators connected to the grid three-phase (PV1) and the radiation level of 400 W/m2 at 0.52%. On the condition of using double tuned passive filter, the largest THD average of grid voltage is generated on the condition of all PV generators connected to the three phase grid (PV1 + PV2 + PV3) and the irradiance level of 800 W/m2 at 0.19%. The smallest average of grid voltage THD produced on the condition of the PV generators connected to the grid three-phase (PV1) and the radiation level of 400 W / m2 of 0.03%. Figure 7 and 8 shows that at the level of solar irradiance remains, the greater number of PV generators connected to three-phase grid, then the greater the value of the voltage THD. Figure 9 also shows that the level of solar irradiace increases, THD average of voltage grid will also increase. THD average of grid voltage is reduced after double tuned passive filter installed.

Table 3 shows that the current value of grid before use double tuned passive filter on the condition only connect one and two generators (PV1 and PV1+PV1) was stable (6.8 Volt). However, if the PV generator connected to the three phase grid is three generators (PV1+PV2+PV3), the current grid in Bus PCC appears unbalanced currents between 6.8 up to 9.2 Ampere. After using double tuned passive filter, grid current value on the condition only connect one and two generators (PV1 and PV1+ PV2) was stable (6.8 Ampere). However, if all PV generator connected to the three phase grid (PV1 + PV2 + PV3), the current grid PCC bus increase to 7.5 Ampere or 10.29%. Without double tuned passive filter, the largest average THD current grid is generated by the condition of three PV generators connected to the grid three-phase (PV1+PV2+PV3) and the irradiance level of 800 W/m2 at 1.93%. The smallest THD avarage of grid current is produced by only single PV generators connected to three phase grid (PV1) and irradiance level of 400 W/m2 at 0.07%. On the condition of using double tuned passive filter, the largest of THD average grid voltage is generated of all PV generators connected to three phase grid (PV1 + PV2 + PV3) and irradiance level of 800 W/m2 of 0.05%.

The smallest average THD of grid current is produced on the condition of the PV generators connected to the grid three-phase (PV1) and the radiation level of 400 W/m2 at 0.00%.

4. Conclusion

The nominal of voltage and current on the PCC bus of three phase grid before use double tuned passive filter on the condition only connect single generator (PV1) is still stable. However, if the PV generator connected to the three phase grid, amounted to more than one generation (PV1+PV2 and PV1+PV2+ PV3), voltage and current grid becomes unstable (fluctuation). At the level of solar radiation remains, the greater number of PV generators connected to the three phase grid, then the nominal of voltage and current THD also increase. At the level of solar irradiance increases, average THD of voltage and current grid also increased. Avarage THD of voltage and current grid is reduced after double tuned passive filter installed in three phase grid. Therefore double tuned passive filter able to improve profile of voltage and current THD grid, as a result of the integration of a number of PV power generators in three-phase grid according with IEEE Standard 519-1992.

5. Acknowledgment

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