

1. Title of the project:

Improvement of life cycle of transformer and induction motor using Point On Wave (POW) switching at low voltage level.

2. Principal Investigator : Name and Affiliation

(1) Dr. Kunal A. Bhatt

Assistant Professor

Electrical Engineering Department

L.D.C.E. Ahmedabad.

3. Principal Collaborator: Name and Affiliation

(1) Prof. (Dr.) Bhavesh Bhalja

Associate Professor,

Department of Electrical Engineering,

Indian Institute of Technology Roorkee

4. Co- Investigator (If any):

(1) Dr. C. H. Vithalani

Professor and Head of Department

(I/C Principal)

Electronics and Communication Department

G.E.C. Rajkot.

(2) Dr. U. L. Makwana

Associate Professor,

Electrical Engineering Department,

L.D.C.E.

5. Research Project Summary 10 lines max.

Nowadays, in the era of micro grid and smart grid, switching transients at low voltage level has gained its importance a lot. In this regard, random switching of the power equipment generates high switching transients. Subsequently, it may decrease the life of the power system equipment and switching device. Further, it deteriorates power quality of the supply. In addition, inclusion of the renewable energy sources enhances the frequency of the switching events due to its time based availability. Hence, it is required to pay attention about the switching transients at low voltage level.

6. Objectives of the project as bullet points:

Our objectives in this research work are:

- To develop a novel POW technique to minimize the level of switching transients.

- Developed novel technique will be able to co-ordinate using Internet of Things (IoT).
- Designed prototype will help to improve the life cycle of electrical equipment.

7. State of the art (with relevant references from major journals)

- Being a mechanical device, it is difficult to attend electrical closing target instant from mechanical closing instant using conventional Circuit Breaker (CB) [1]-[3].
- Nowadays, due to exponential rise in power electronic technology, static CB are used for low voltage application. This helps to attain closing target of POW with good accuracy [2],[4].

8. Novelty of the project:

In this era, research on the concepts of micro-grid and smart grid areas promoted by large. Here, the operating voltages is Low Voltage (LV) or High Voltage (HV) level. This creates some opportunity for the researcher to carry out their research at LV/HV level. Moreover, in this environment, usage of renewable energy sources is one of the prime important activities. However, limited period availability during the day of few renewable sources causes frequent switching. These switching causes switching transients. Subsequently, we would like to carry out our research work in the field of switching transients. This will help to improve the life cycle of the power equipment.

9 Work plan and methods:

POW Switching technique has been implemented in the real field for Extra High Voltage (EHV) and Ultra High Voltage (UHV) level by some of multi-national companies such as A.B.B. Ltd. and Siemens Ltd. Still it is state of art technique. Till now, its application on HV and LV levels has not been explored. Hence, we would like to explore this field. Particularly, it is essential to implement the application of POW for mitigation of inrush current during energization of transformers and induction motor at LV level. Energization of transformer and induction motor require different closing targets. Theses targets needs to identify. In order to improve personal safety, IoT can be used to perform the switching remotely.

10. Part of the project work, which will be conducted in collaborative institute, clearly bringing out the added value due to collaboration and the infrastructure facilities related to the project activity available in the institutions where the project work will be carried out:

Hardware setup of this project work will be fully carried out at host institute (i.e. L.D.C.E. Ahmedabad, Gujarat). However, active support to identify different closing targets for energization of transformer and induction motor and simulation support will be provided by collaborated institute.

11. Potential applications (if any):

- To design and test the performance of static CB.
- Testing panel to evaluate the performance of POW switching techniques.
- L.V panels for transformer and induction motor.
- Testing panel to incorporate IOT for switching.

12. Details of currently running projects with the Collaborators (titles, funding agencies, budgets, starting date, duration) :

Not Applicable

13. Any other information:

Hardware setup of this project work will be carried out at department of Electrical Engineering, L.D.C.E. Ahmedabad, Gujarat. Software support (as and when needed) will be provided by collaborating institute.

14 Departmental Faculty members

1. Prof. Mitul G.Patel Assistant Professor, EED
2. Prof. Fedrik A. Macwan Assistant Professo, EED

- [1] K. A. Bhatt and B. R. Bhalja, "An approach for controlled energization/re-energization of shunt compensated transmission lines," *Int. J. Electr. Power Energy Syst.*, vol. 120, p. 105986, Sep. 2020.
- [2] K. A. Bhatt, B. R. Bhalja, and U. Parikh, "Evaluation of controlled energization of shunt reactors for minimizing asymmetric DC component of charging current with circuit breaker having pre-insertion resistors," *Int. J. Electr. Power Energy Syst.*, vol. 93, pp. 340–351, Dec. 2017.
- [3] K. A. Bhatt, B. R. Bhalja, and U. B. Parikh, "Evaluation of controlled energisation of an unloaded power transformer for minimising the level of inrush current and transient voltage distortion using PIR-CBs," *IET Gener. Transm. Distrib.*, vol. 12, no. 11, pp. 2788–2798, Jun. 2018.
- [4] K. A. Bhatt, B. R. Bhalja, and U. Parikh, "Controlled switching technique for minimization of switching surge during energization of uncompensated and shunt compensated transmission lines for circuit breakers having pre-insertion resistors," *Int. J. Electr. Power Energy Syst.*, vol. 103, pp. 347–359, Dec. 2018.



Directorate of Technical Education, Gujarat State

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NO:-DTE/Research Promotion-STEM/LA/2020-21/

2976

Date:

08 MAR 2021

To,
Dr. Kunal A. Bhatt
Electrical Department,
L.D. College of Engineering, Ahmedabad

Sub: Award of Research Grant for Research Promotion under Technical Education-STEM

Ref: શિક્ષણ વિભાગનો તા.૧૭/૧૨/૨૦૨૦નો ઠરાવ ક્રમાંક:ટીઈએમ-૧૦૨૦૨૦-૧૨૭૬-સ

Dear Sir,

Warm Greeting from Directorate of Technical Education, Gandhinagar.

With reference to your project proposal on "**Improvement of life cycle of transformer and induction motor using point on wave(POW) switching at low voltage level**" and subsequent presentation before the Approval Committee on 23/02/2021, Directorate of Technical Education, Gandhinagar is having the great pleasure to inform you that your research proposal has been conditionally accepted for Research Promotion under Technical Education-STEM. The research grant of Rs. 1.996 Lakh will be sanctioned in accordance with modalities and guidelines of the Research Promotion under Technical Education-STEM GR.

The disbursement of the grant will be done as per the following conditions:

- 1) The Letter of Undertaking has to be signed by the principal investigator and head of the institute and the send the same to this office within three working days.
- 2) The research grant will be disbursed through IFMS portal to DDO of the institute
- 3) The disbursement of the research grant will be done as per the GR conditions.

With best regards,

Joint Director
Directorate of Technical Education, Gandhinagar