

06/07/2024

To,  
The Principal,  
Amrutvahini College of Engg,  
Songamner.

Subject: Request to get incentive under Research Incentive Scheme

Respected Sir,

with reference to above mentioned subject, I Rotde Jyoti R requesting to get incentive under Research Incentive scheme of Research and development department.

I have published a paper titled as "Linear regression approach for performance evaluation of ES with load impedance variations of non-critical and critical load" in e-prime- Advances in Electrical Engineering, Electronics and energy which elsevier journal.

I am requesting you, kindly give the applicable incentive under said scheme.

I have attached requisite documents

- i> Journal home page print
- ii> Published paper print

Thanking You

Yours faithfully,

Rotde

J. R. Rotde  
Assistant Professor  
Dept of Electrical Engg  
9960526427

Respected Sir,  
Recommended for sanction.

Wey  
8.7.2024.

Respected Principal Sir,

As per R & D Policy  
RS. 2000/- Can be  
Provide for scopus paper. Wey  
stays

AIC  
Allowed  
Wey

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A linear regression approach for performance evaluation of ES with load  
impedance variations of non-critical and critical loadJ. K. Kulkarni<sup>a</sup>, Archana G. Thosar<sup>b</sup><sup>a</sup> Department of Electrical Engineering, Amravati College of Engineering, Sangamner, Maharashtra, India  
<sup>b</sup> Department of Electrical Engineering, COEP Technological University, Pune, Maharashtra, India

## A B S T R A C T

Due to the strengthening of decentralized power generation technology, renewable energy sources (RES) are developing moderately as next-generation additions to the modern power system. However, dense penetration of RES disturbs the stability of voltage and frequency. The Electric spring (ES) is a new advanced device that deals with voltage fluctuations due to the intermittent nature of RESs in distributed networks. Electric spring is an emerging demand-side management technique in the smart grid that can support the weakly regulated system voltage. This paper investigates the effect of load impedance variation of non-critical load and critical load on the performance of ES through MATLAB simulations. The loads considered are linear. The results obtained from the simulation study are used to construct a mathematical model using a simple linear regression technique. The results from the simulation study and linear regression analysis are similar. It is observed that the linear regression approach outperformed the simulation approach in terms of time complexity and predicted the real and reactive power management provided by ES for under-voltage and over-voltage conditions.

electronics-based reactive power controller that uses input voltage control to maintain the voltage of critical load at reference value. It was introduced by Shu Yuen (Ron) Hui [3]. The operation of an electric spring is similar to that of a mechanical spring, which works according to hook's law. The ES regulates the voltage with reactive power compensation using input feedback and input voltage control instead of output voltage control. Most of the work has been done on the application of ES, which includes: i) voltage regulation in the micro-grid and isolated power system [4–6], ii) improving power quality to stabilize the power system [7–10], iii) neutral current mitigation in the micro-distribution grid [11–13], iv) reduction in energy storage requirement in the micro-grid [14], v) transient stability improvement in islanding operation [15,16], vi) mitigation of frequency regulation in the micro-grid [17–20], vii) use of consensus and droop control to coordinate several ESs [21–23]. The application The ES performance is determined with a change in line impedance in [24], the performance of ES is analyzed with the ratio of the load impedance of the critical load ( $Z_{cl}$ ) to the load impedance of the non-critical load ( $Z_{ncl}$ ) in [25], and it is found that performance of ES depends on the ratio of  $Z_{cl}$  and  $Z_{ncl}$ . Still, the literature [26] claims that the performance of ES relies on the type of load impedance and the absolute value of the non-critical load.

Energy crises have accelerated the transition from fossil fuels to clean and green energy. To achieve this, renewable energy solution. Using renewable energy sources, green energy has a vast potential to reduce dependence on coal, natural gas, etc. and meet the growing demand for energy. Renewable energy sources such as solar and wind are intermittent and can destabilize the interconnecting power systems voltage fluctuations on the grid side. To address this issue, the use of DSM with ES (ES-DSM) is the solution. The use of DSM with ES provides the smart grid concept. There, the operation side is on the load side. The techniques include real-time pricing, direct load control, energy storage system, etc. Most of these methods require a communication network, some are costly, and some are not suitable [2]. Therefore, electric spring is introduced as a demand-side management method focusing on the control of the load side. The ES is used for instantaneous power balancing, power

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