TEST Engineering & Management

March - April 2020
ISSN: 0193-4120 Page No. 9395 - 9398

A Novel design Solution to Reduce Load Variations in DC-DC converter for Microgrid using Ordinary Differential Equations

N.Vinothkumar[1],Tamilarasu Viswanathan[2]
[1,2]Assistant Professor Electrical and Electronics Engineering Kumaraguru College of Technology Coimbatore, India
vinothkumar.n.eee@kct.ac.in[1], viswanathan.t.eee@kct.ac.in[2]

Article Info
Volume 83
Page Number: 9395 - 9398
Publication Issue:
March - April 2020

Article History
Article Received*: 24 July 2019*
Revised*: 12 September 2019*
Accepted*: 15 February 2020*
Publication*: 09 April 2020*

Abstract

This paper offers a new design solution for reducing the load variations impact on the DC-DC converter applied for micro grid using Ordinary differential Equations (ODE). After applying the proposed scheme, the chance to remove the load effects on sudden variations in the loads and encounter the practical restrictions of DC-DC converters involvement controller and state space signals. Initially, the model of the DC –DC converter, is match with an ideal initial values for better development of the system. This method can extended to solve with general Runge - Kutta (RK) method up to 5th order ODE up to 100th steps. After the different execution data, the design solutions are take out as solutions. These new design and verified with actual load variation and produced exceptional results through simulation

Keywords; *DC-DC converter, Ordinary differential equations, R-K method, load variations*

I. INTRODUCTION

DC-DC controllers are used in Micro grid applicationsbecause of their toughness and strength in power transfer. In real-world case,DC-DC controllers able to occupy in wide range of level at immeasurable, variable, and wide switching periods and different load conditions for providing steady state operation in any power system applications.On the other hand, the limitation in designing of DC-DC converter parameters such as inductor, capacitor design and switching limitations of power switches is confronted to achieve the incremental or sudden load variations.In starting stage of the various research works, the DC-DC converter and micro grid characteristics are separately studied. They match after the certain point with respect to design variable which is critical for load variations. In order to utilize the full capability of DC-DC converter, the direct study must involve to achieve the micro grid load variations respective to DC-DC converter design parameters. To achieve this there are many method is suggested. But in this paper an ODE based iterative method is offered with wide range of considering the real time parameters[1-2]. The ODEs are often used with iteration based problem solving the parameter based optimization for fast convergence with ideal cases and maximize the parameter variations leads to wide range of micro grid problems[3-5]. This analysis enumerate values are preloaded for wide range of design considerations through already designed problems in the existing research. Once the refilled data is match with existing load condition, the further more optimization is not needed. In this paper, the three design parameters taken into account and achieve the variation of the parameters for load variation is match up with other three microgrid limitations. In the next section, the general design concern of the proposed and the parameters used is discussed. Step by step process for achieving the suggested iterative

Published by: The Mattingley Publishing Co., Inc.

TEST Engineering & Management

March - April 2020
ISSN: 0193-4120 Page No. 9395 - 9398

process is described in section III. In fourth portion, the discussion of the suggested for different load conditions is clarified. In the Final section, the next lead of the proposed work is described.

II. GENERAL DESGIN CONSIDERATION FOR DC-DC CONVERTER

For analysis, here the standard Lithium-ion battery is consider as input supply The standard Thevenin's equivalent of the battery model is presented in Figure 1.

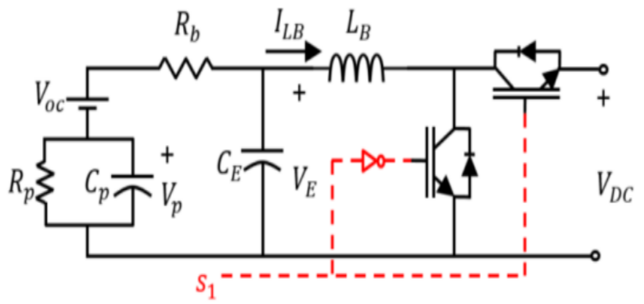

Figure.1. Thevenin Equivalent model of input battery used in DC-DC converter

The general average model or state space model for the proposed DC-DC converter is transcribed as

$$C_E \frac{dV_E}{dt} = \frac{V_P + V_{OC} - V_E}{R_b} - I_{LB} \quad (1)$$

$$C_B \frac{dV_{DC}}{dt} = I_{LB}S_1 - I_{SC}S_2 + I_{MG} \quad (2)$$

$$L_B \frac{dI_{LB}}{dt} = V_E - V_{DC}S_1 + I_{LB}R_{LB} \quad (3)$$

Where the V_E, V_P, V_{DC}, V_{OC} and I_{LB} are ideal source, over voltage, supply voltage and battery fundamental parameters respectively. These parameters are taken into ideal case for load variations these state space equation solve using ODEs which explained in the next section.

III. ODE FOR DESIGNING CONVERTER PARAMETERS

In ODEs, the typical statistical iterators RK method is selected for fitting step value is used for control[6-8]. The design solution for the DC-DC converter ODE has two extreme interval measures which fluctuate by instructions of degree, only inflexible estimators are valuable. Inappropriately, the constant of direct variables is subject to second imitative variable and unknown. Furthermore, a high combination accurateness is required for attaining a proper imitative.

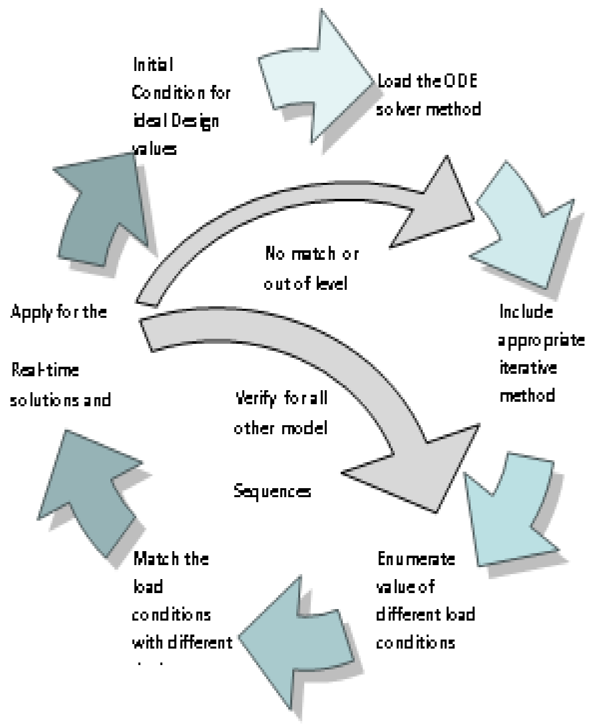

Figure.2. Overview of design Solution to Reduce Load Variations in DC-DC converter using ODEs

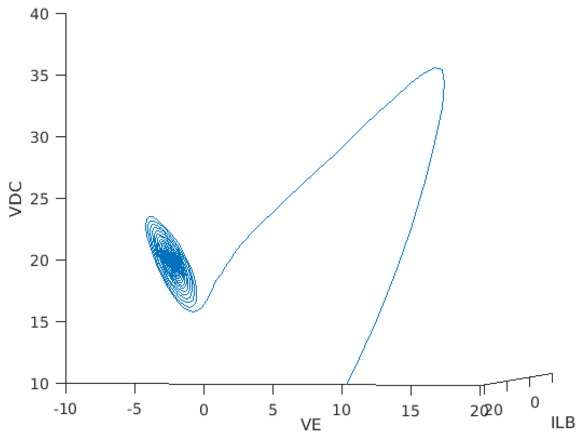

Figure 3.Design parameters for DC-DC converters from initial value I_{LB} vs. V_E vs. V_{DC}

Published by: The Mattingley Publishing Co., Inc.

March - April 2020
ISSN: 0193-4120 Page No. 9395 - 9398

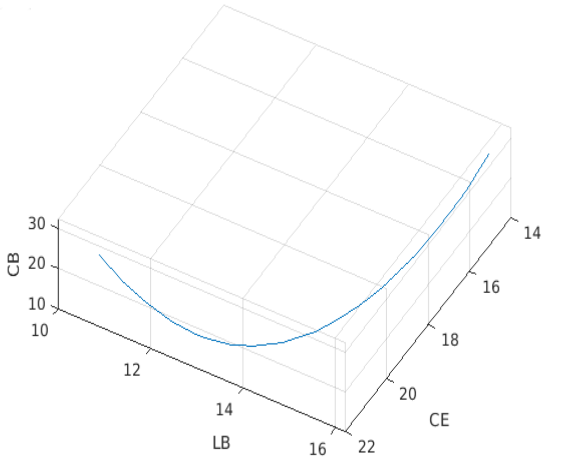

Figure 4.LoadVariation in parameters after running the RK method for L_B vs. C_E vs. C_B

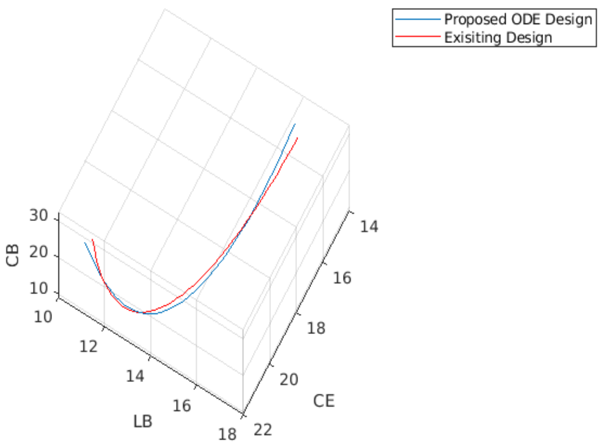

Figure 5.Comparision of proposed after load variations after L_B vs. C_E vs. C_B

IV. DISCUSSION

The comparison of different load conditions for V_E, V_P, and I_{LB} with the load dependent parameters L_B, C_E and C_B mention in Table 1. It clearly shows that for ideal case 100 % load, per unit value is taken as reference. When the load varied suddenly, the high and medium conditions. The proposed scheme validates design and verify the simulation results.

TABLE I . PARAMETERS VARIATIONS FOR DIFFERENT LOAD CONDITIONS (ALL ARE IN PER UNIT)

Load Condition	V_E	V_{DC}	I_{LB}	L_B	C_E	C_B
No load	0.89	0.91	0.91	1	1	1
33 %	0.92	0.93	1	1	1	1
50 %	0.96	0.99	1	1	1	1
100 %	1	1	1	1	1	1
125 %	1.1	1.08	1.12	1.81	1.31	1.21

V. CONCLUSION

The limitation design approximation process for ODEs, numerous solutions, is studied and defined its feature.In the other way to maintain the different load variations are part of the ODE equation solve in differential equations.The standard ODE solving procedure in included with range of load conditions and the ideal case of DC-DC converter parameters. This scheme is validated through different loading conditions by considering the three parameters in load side and reflect or control by the DC-DC converter fundamental parts. In the future, the scheme is validated and include more steps by means of hardware validation.

REFERENCES

[1]. Y. Wang, E. K. Teoh, and D. Shen, “Lane detection and tracking using B-Snake,” Image Vis. Comput., vol. 22, no. 4, pp. 269–280, Apr. 2004.

[2]. D. Koller, J. Weber, and J. Malik, “Robust multiple car tracking with occlusion reasoning,” in Proc. 3rd Eur. Conf. Comput. Vis., Stockholm,Sweden, May 1994, pp. 189–196.

[3]. Vinothkumar,.V.KumarChinnaiyan, Pradish.M and Prabhakarkarthikeyan, “Recommend cascade structure multilevel inverter with reduced power electronic components”,

Published by: The Mattingley Publishing Co., Inc.

Electric Power Components and Systems, Taylor and Francis publications 0(0), 1-6. DOI.doi.org/10.1080/15325008.2018.1496370

[4]. Vinothkumar,.V.KumarChinnaiyan, Pradish.M and Prabhakarkarthikeyan, "Multilevel Inverter Structure using Single Source and Double Source Module to Reduce Power Electronics Components", **IET The Journal of Engineering**, pp. 1-10, March 2017 (DOI:dx.doi.org/10.1049/joe.2017.0068).

[5]. Vinothkumar N, Viswanathan T, and Mathankumar M, Intelligent street light controller with security system, IJITEE, 2S, 2018, 1-6

[6]. Vinothkumar N, Sequential Quadratic Programming (SQP) Based Selective Harmonic Elimination for Multilevel Inverter, IJITEE, 2S, 2018, 94-98.

[7]. N. Vinothkumar, V.KumarChinnaiyan and Pradish.M "Comparative analysis of SHE techniques for seven and nine level inverter with CSA, PSO and SA algorithms" Journal of electrical engineering (Communicated)

[8]. N.Vinothkumar,V.KumarChinnaiyan,Pradish. M and Prabhakarkarthikeyan, "Simulated Annealing Based Selective Harmonic Elimination for Multi-level Inverter", Elsiver energy procedia, 17C, pp. 790-796,2017