

## VOLTAGE LOAD SHEDDING CONSIDERING VOLTAGE SENSITIVITY AND REACTIVE POWER

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**Abstract.** Load shedding is the last reaction to control and stabilize the power system in the event of a disturbance. Determining the location and amount of load shedding is one of the issues that has always plagued the users of the power system. In this paper, a new method is proposed to determine the appropriate bus for voltage load shedding. In the proposed method, unlike the previous methods, two indices of voltage sensitivity to active power and reactive power are used many times to determine the appropriate bus for voltage load shedding. Considering the reactive power many times in the process of determining the appropriate bus for voltage loading causes more reactive power to be cut off in the initial stages of voltage loading and the voltage profile is improved. As a result, less active power is cut off by voltage load shedding. The proposed method is implemented together with the method based on voltage sensitivity to active power in the IEEE 118-bus test network and the New England 39-bus network to test the correctness of the proposed method. The results of the paper show the superiority of the proposed method over the voltage sensitivity method to active power.

**Keywords:** *voltage stability, voltage load shedding, effective bus, reactive power, voltage sensitivity*

### Introduction

Safe and economical operation of power systems requires a balance between output and consumption power and voltage stability. Occurrence of any disturbance in the power system, such as generator and line outages, may affect the security of the power system and cause voltage instability. Voltage stability is defined as the ability to maintain a steady state voltage in all components of the system after a perturbation occurs and can be studied in three periods: short-term, medium-term and long-term (Kundur et al., 2004). Preventive and corrective methods are used to maintain the voltage within the allowable range. Preventive methods are used when the power system is in the alarm phase and has not yet entered the critical phase. Redistribution of active and reactive power are among the preventive methods. If preventive methods cannot return the system to normal, then corrective methods such as shifting production and load shedding are activated (Amouzad Mahdiraji and Sedghi Amiri, 2020). Among the corrective methods, load shedding (voltage and frequency) is used as a last resort to maintain the stability and integrity of the power system (Brown and Moreno-Centeno, 2020). In most studies of voltage decontamination, static studies have been used to perform decontamination.

In these methods, the goal is to find an acceptable solution for the load distribution equations, and intelligent optimization methods are used to minimize the amount of

loading (Brown and Moreno-Centeno, 2020; Amouzad Mahdiraji and Shariatmadar, 2019a; He et al., 2019). Because intelligent optimization methods require a lot of time. Therefore, the methods that use these algorithms are not suitable for dealing with short-term voltage instability. Also, static studies-based voltage deflections cannot account for the effects of dynamic equipment such as motors and automatic voltage regulators (Lei et al., 2014). Methods based on dynamic studies have been proposed to consider dynamic phenomena in voltage relief (Lei et al., 2019; Hamid et al., 2014; Arief et al., 2011). In dynamic methods, the information required for loading can be obtained either through simulation of a power system in the time domain or by wide area measurement systems. In Mahari and Seyedi (2016) a voltage load shedding method is proposed to optimize the load shedding amount. The proposed method uses the data sent by PMUs and optimizes the load shedding value using the modified DICA algorithm. Although the method presented in Mahari and Seyedi (2016) requires little time and its convergence speed is high, but it cannot be used for short-term voltage instability.

In Kaffashan and Amraee (2015), voltage load shedding has been investigated several times considering the uncertainty of loads and load distribution results have been used to minimize the amount of voltage load shedding. The method proposed in Kaffashan and Amraee (2015) involves a new approach to voltage desalination, but because it uses load dissipation results, it is not able to consider the effect of dynamic equipment. In Ahmadi and Alinejad-Beromi (2015) a load shedding method using integer modeling is presented and in it, various goals such as minimizing the cost of load shedding are considered. As with other methods based on intelligent optimization methods, the method presented in Ahmadi and Alinejad-Beromi (2015) cannot be used to deal with short-term voltage instability. Also, this method receives the required information from the load distribution and cannot consider the effect of dynamic equipment in the load shedding process. In Amouzad Mahdiraji and Shariatmadar (2019b), as well as Arief et al. (2013) stated the load buses are ranked by trajectory sensitivity analysis, which is a function of voltage sensitivity to active power. Then the bus with the highest trajectory sensitivity is selected as the appropriate bus to perform voltage load shedding. In Mehrabi et al. (2019), the appropriate bus for voltage relief is determined by calculating the voltage sensitivity to the active power in the critical bus. The critical bus is the bus that has experienced the most voltage drop due to an error.

Voltage-sensitive methods based on active power do not use intelligent optimization methods to minimize the amount of load shedding and can obtain the required information in addition to load distribution from dynamic simulations and PMUs. Therefore, these methods can deal with short-term voltage instability and can consider the effect of dynamic equipment. Voltage sensitivity methods try to reduce the amount of load shedding by selecting the best bus for voltage load shedding. In methods based on voltage sensitivity to active power, the appropriate bus for load shedding is determined only by the voltage sensitivity to active power, but in some cases, the critical bus voltage sensitivity to active power may be two or more. In these cases, in addition to the sensitivity of the voltage to the active power, another indicator should be used to select the most effective bus to perform voltage loading in order to further reduce the amount of load shedding. One of the indicators that can be used to make decisions is reactive power, because as the reactive power demand in the network decreases, the voltage stability of the power system improves (Hamid et al., 2014; Tang et al., 2013).

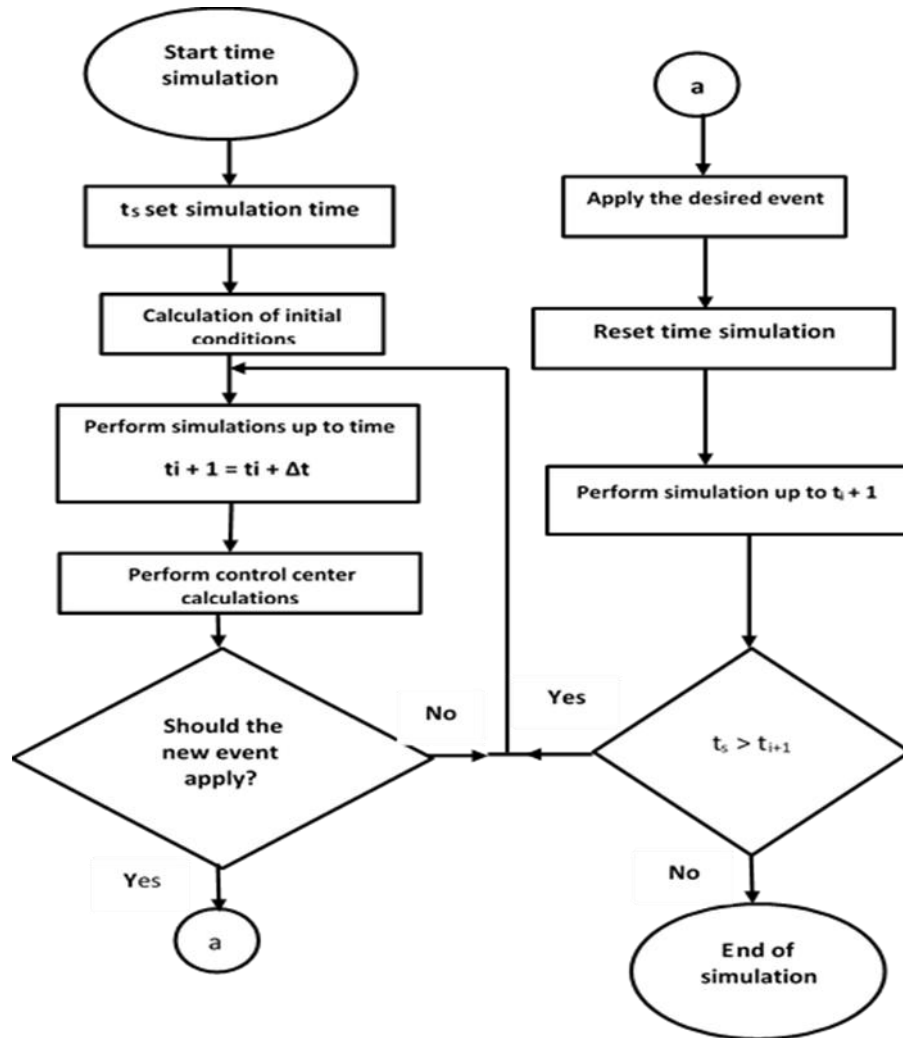
In this paper, a new method based on voltage sensitivity to active power and reactive power is repeatedly proposed to determine the appropriate bus for voltage load shedding. For this purpose, a two-indicator equation is presented which is a combination of weight of reactive power of loads and voltage sensitivity to active power of loads. Because the proposed method does not use intelligent optimization methods, this method is suitable for dealing with voltage instability in all three short-term, medium-term, and long-term intervals. Also, the information required for load shedding is collected using PMUs. Therefore, the method proposed in this paper can consider the effect of dynamic equipment.

## Materials and Methods

### *Modeling the delay caused by calculation and sending information*

In this section, how to model the delay due to computation in the control center and the delay caused by PMUs using the DPL capability of Digsilent software is examined. For this purpose, first, some key features of Digsilent software for time simulation are examined. To perform temporal simulation in Digsilent software, in addition to the basic network conditions, the events specified for temporal simulation must first be examined and then temporal simulation performed. In other words, the software first checks all the initial conditions and events defined in the software (such as equipment entry and exit) and then begin to simulate time. Therefore, if during the time simulation, an event such as load removal is defined by the user using DPL, this event will be in the time simulation until the time simulation is started from the beginning. Not considered. In addition, until the time simulation performed in the Digsilent software starts from the beginning, the new time simulation will not be reset from continuing the time simulation, the second time simulation from time  $t_1$  to time  $t_2$  which  $t_2 < t_1$  will be done.

According to the explanations provided, the method shown in *Figure 1* is used to consider the computation delay and the PMU delay in the Digsilent software using DPL. According to *Figure 1*, first the time required to perform the time simulation ( $t_s$ ) is determined and the initial conditions are calculated. Then the time simulation starts with time zero ( $t_i = 0$ ) and with time steps  $\Delta t$ . Centralized control methods used in control centers require a telecommunications platform to receive the required information from PMUs. In addition, calculations in dispatching centers take time, and therefore the value of  $\Delta t$  should be considered equal to the time required to measure and transfer information to the control center and perform calculations in that center. After performing the calculations in the control center, if there is no need to apply a new event in the power system, the simulation is performed for the next  $\Delta t$ . The event in question can be the disconnection or connection of various types of equipment or load. If a new event needs to be applied, the desired event is applied first and the time simulation calculations start from zero so that the desired event is considered in the time simulation. The simulation is then performed up to  $t_i + 1$  without resetting the simulation. If the simulation time reaches  $t_s$  time, then the simulation time stops.



**Figure 1.** Modeling of delays due to computations in the control center and delays due to sending information in Digsilent software using DPL capability.

### ***Voltage sensitivity to active power***

The voltage sensitivity of one bus to changes in the injected active power in the other bus of the power system can be evaluated by the Jacobin matrix. The Jacobin matrix in the power system is defined as Eq. (1):

$$\begin{bmatrix} \Delta P \\ \Delta Q \end{bmatrix} = \begin{bmatrix} J_1 & J_2 \\ J_3 & J_4 \end{bmatrix} \begin{bmatrix} \Delta \delta \\ \Delta V \end{bmatrix} \quad \text{Eq. (1)}$$

In Eq. (1)  $\Delta P$  and  $\Delta Q$  are changes in the active and reactive power injected into the bass, and  $\Delta V$  and  $\Delta \delta$  are the changes in the voltage range of the basses and changes in the angle of the voltages. By separating the equations for active and reactive power changes, we have:

$$\Delta P = J_1 \Delta \delta + J_2 \Delta V \quad \text{Eq. (2)}$$

$$\Delta Q = J_3 \Delta \delta + J_4 \Delta V \quad \text{Eq. (3)}$$

Voltage angle variations can be obtained as follows using Eq. (2) (Amouzad Mahdiraji et al., 2018):

$$\Delta\delta = J_1^{-1}\Delta P - J_1^{-1}J_2\Delta V \quad \text{Eq. (4)}$$

By placing Eq. (4) in Eq. (3) and obtaining the voltage changes according to the changes, we will have active and reactive power (Amouzad Mahdiraji et al., 2018).

$$\Delta V = J_{RQV}^{-1}\Delta Q - J_{RQV}^{-1}J_3J_1^{-1}\Delta P \quad \text{Eq. (5)}$$

$$J_{RQV} = J_4 - J_3J_1^{-1}J_2 \quad \text{Eq. (6)}$$

Regardless of the reactive power changes, the voltage sensitivity to the active power changes ( $S_{VP}$ ) is given as Eq. (7).

$$S_{VP} = \frac{\partial V}{\partial P} \approx \frac{\Delta V}{\Delta P} = -J_{RQV}^{-1}J_3J_1^{-1}\Delta P \quad \text{Eq. (7)}$$

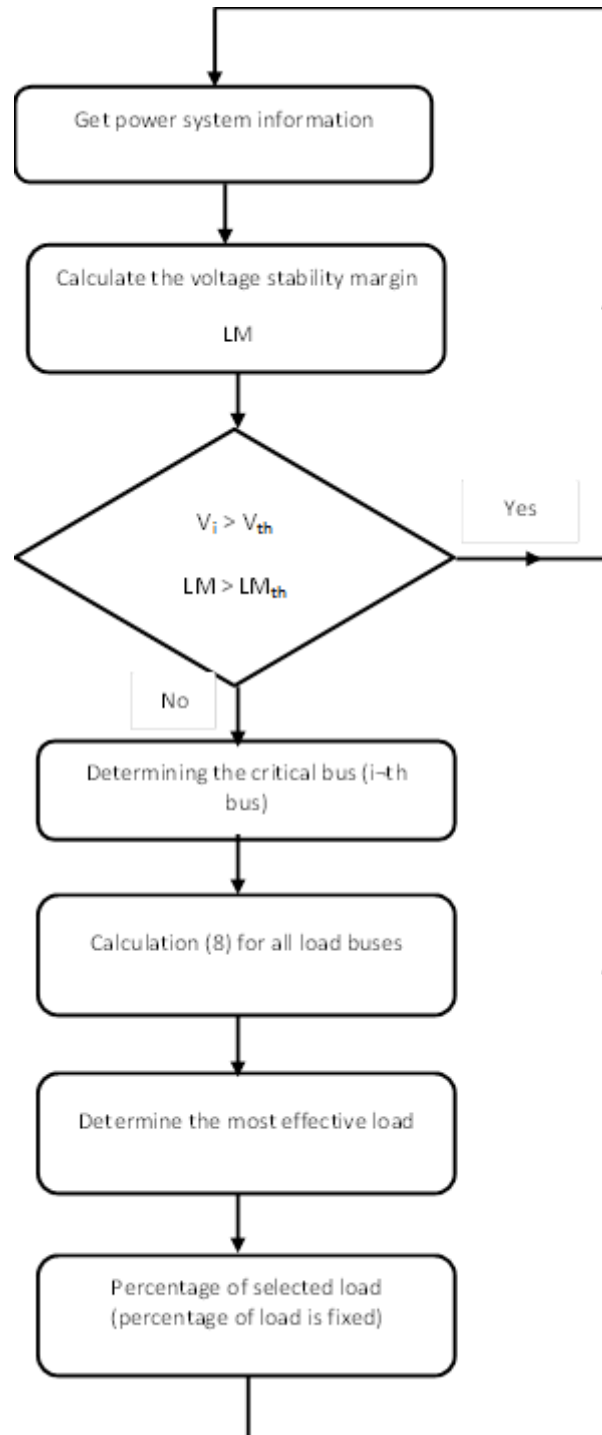
### ***The proposed method for voltage load shedding***

In the sensitivity method, the voltage sensitivity to the active power is used to determine the appropriate bus to perform voltage load shedding. In the proposed method, in addition to the voltage sensitivity index to the active power, reactive power is often used to determine the appropriate bus for voltage load shedding. Considering reactive power often causes more reactive power to be cut off and the voltage profile to be improved. As a result, less active power is cut off to maintain voltage during the load shedding process. To consider the reactive power of loads, an equation that is a weight function of the sensitivity of voltage to active power and reactive power of loads is proposed. This weight function is as follows (8) and is calculated only for buses that have a load.

$$LBR_j = K_1 \frac{S_{VPj}}{S_{VPmax}} + K_2 \sin\phi_j \quad \text{Eq. (8)}$$

In Eq. (8)  $LBR_j$  the load cut-off priority on the bus  $j$ -th,  $\phi_j$  the angle of the load power factor on the bus  $j$ -th,  $S_{VPj}$  the sensitivity of the critical bus voltage to the active power once in the power system, and  $K_1$  and  $K_2$  weight coefficients Are often dependent on the structure of the power system and reactive power. The bus with the highest  $LBR$  is the most effective bus for voltage load shedding. According to the above, the proposed voltage load shedding process can be expressed in *Figure 2*. According to this figure, first, the required information is received from the power system and then the voltage stability margin for the power system is calculated. The bus voltage and voltage stability margin are calculated for the power system. The bus voltage and the system voltage stability margin are compared with the threshold values ( $V_{th}$  value of the voltage threshold value and  $LM_{th}$  value of the voltage stability margin threshold value) if the bus voltage and the power system voltage margin are less than the threshold values. Voltage load shedding operation begins. In the proposed method, two indicators are used to activate voltage relief because in networks where the percentage of reactive power compensation is high, using only the voltage range to

activate voltage relief is not a suitable indicator and the range should be Voltages should be used in conjunction with another indicator that is usually related to voltage stability (Sasikala and Ramaswamy, 2011). After activating the voltage load shedding, first, the bus that has experienced the most voltage drop due to the fault is selected as the critical bus. Then Eq. (8) is calculated for all load buses. A bus with a higher LBR value is the best bus to perform load shedding, and a fixed percentage of its active and reactive power is cut off (Xu et al., 2014; Wang et al., 2011). The information received from the PMUs is then studied in the next to select a new load for load shedding. Each time it is selected for load shedding, only a fixed percentage is cut off, and more than one cut is subject to selection in subsequent stages. This process continues as long as the bus voltages and the voltage margin of the power system exceed the threshold values



*Figure 2. Proposed load shedding view process.*

## Results and Discussion

### Simulation results

In this section, the performance of the voltage reloading method is based on voltage sensitivity to active power, and the proposed method in the IEEE 118 bus network (Amouzad Mahdiraji and Shariatmadar, 2019c) and the New England 39 bus network (Mahdiraji and Amiri, 2021) is evaluated. In these networks, governors and AVRs are

modeled by IEEE Type I models. They have also been modeled as Eq. (9) and Eq. (10) (Hatziaargyriou et al., 1994).

$$\frac{P}{P_0} = 0/83 - 0/3 \frac{V}{V_0} + 0/47 \left(\frac{V}{V_0}\right)^2 \quad \text{Eq. (9)}$$

$$\frac{Q}{Q_0} = 6/7 - 15/3 \frac{V}{V_0} + 9/6 \left(\frac{V}{V_0}\right)^2 \quad \text{Eq. (10)}$$

According to the WSCC, a power system must have a safety margin of at least 5% in normal operation (Abed, 1999). On the other hand, in most power grids, voltage decoupling usually starts at voltages below 0.9 pu (Mollah et al., 2012). Therefore, in this paper, the values of  $V_{th}$  and  $LM_{th}$  are considered equal to 0.9 and 5%, respectively. Also, to prevent voltage deactivation in the normal fault elimination process, voltage depletion must be activated with a delay (Mehrabi et al., 2019). A typical value for this delay can be considered equal to 3 seconds (Mollah et al., 2012). According to the standard, the amount of delay in sending and receiving information should be less than 100ms (Shun et al., 2016). Therefore, the value of  $\Delta t$  is considered to be 150ms, of which 50ms is related to information processing in the control center. Data processing time can be less than or more than 50ms, depending on the power of the computer used in the control center. The amount of load shedding steps in the IEEE 118-bus test network is 10% and in New England, the 39-bus network is 5%, because the load size in the New England 39-bus network is larger than the IEEE 118-bus test network.

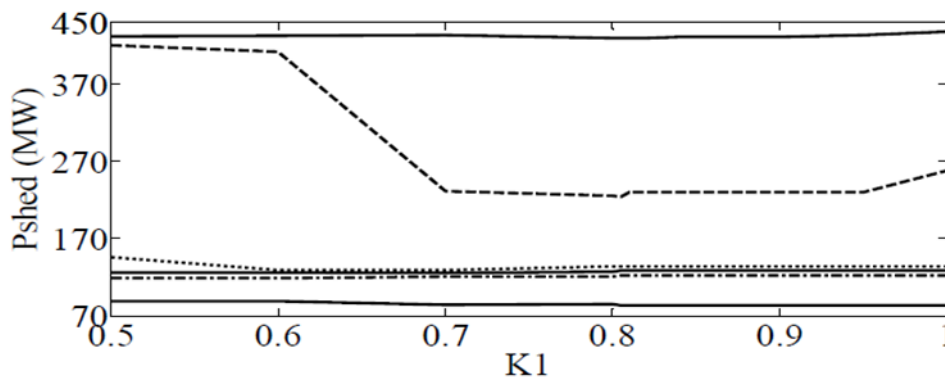


Figure 3. Changes in the amount of load shedding relative of  $K_1$ .

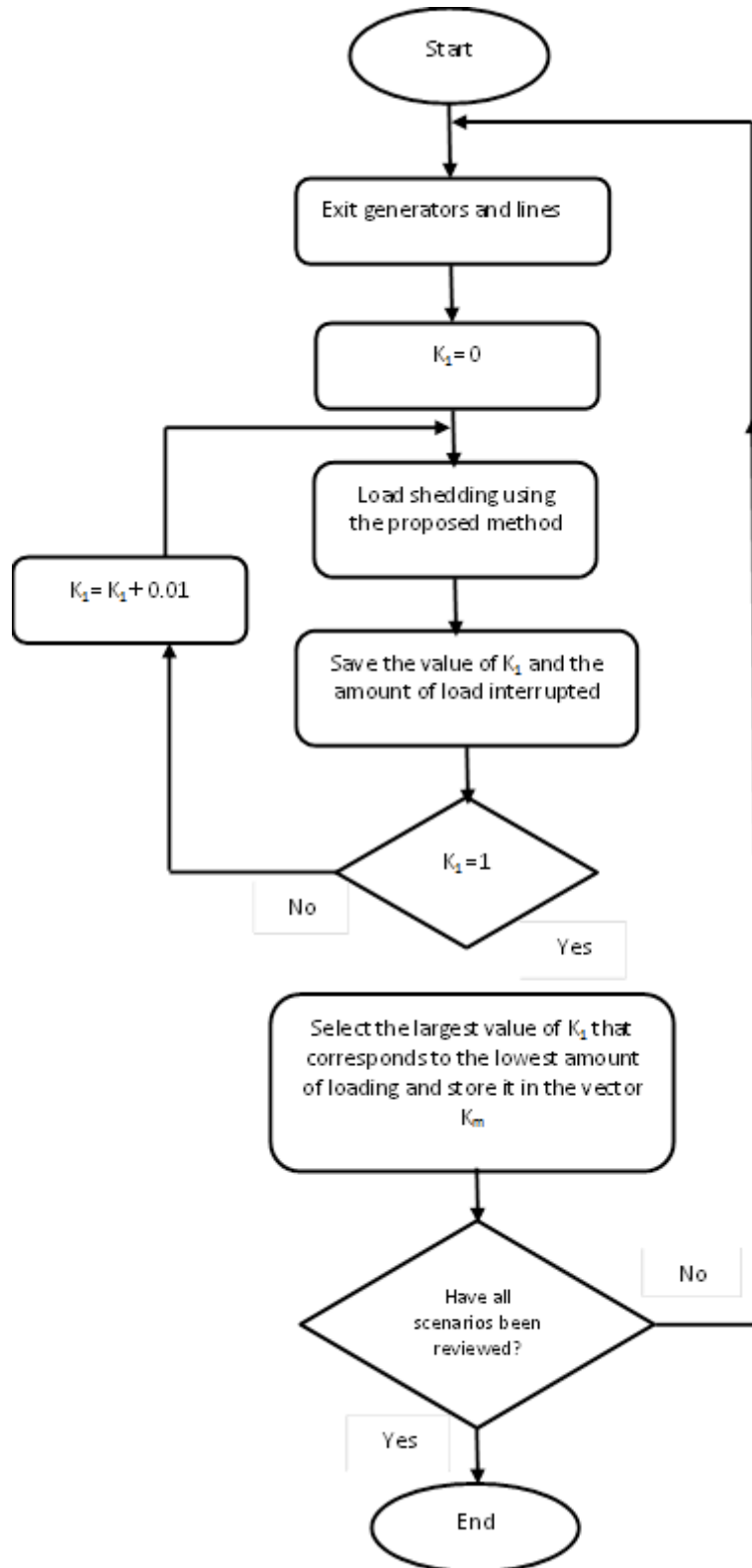
### Determining the weight coefficients $K_1$ and $K_2$

The most important issue in the proposed load shedding method is to determine the weighting coefficients  $K_1$  and  $K_2$ . These coefficients depend on the network configuration and power system loads, and if not selected correctly, the amount of load shedding will increase. To get a better view of how the loading value changes than to change the  $K_1$ , Figure 3 shows these changes for the IEEE 118-bus test network and 6 scenarios. According to Figure 3 with decreasing  $K_1$ , first the number of interrupted load decreases and then continues increases. In other words, if the value of  $K_1$  is selected correctly, the amount of load shedding can be reduced in the proposed method. For the amount of load cut by the proposed method to always be equal to or less than the voltage sensitivity method, the value of  $K_1$  must be chosen large enough. If the value of  $K_1$  is selected equal to the largest value obtained from the examination of

different outputs, it can be ensured that the amount of load cut in the proposed method will always be less than or equal to the voltage sensitivity method to the active power. Concerning changes in the amount of load shedding relative to changes in  $K_1$ , a method similar to that shown in *Figure 4* is proposed to determine  $K_1$ . In this method, the output of lines, generators, and a combination of the output of lines and generators are examined. In each case, the value of  $K_1$  is first set to zero and the voltage decontamination is performed using the proposed method. Then the value of  $K_1$  and the interrupted load are stored. For each exit, this process is repeated until  $K_1$  reaches number one, after which the largest value of  $K_1$ , which corresponds to the lowest amount of load shedding, is stored in the vector  $K_m$ . After checking all the outputs, the values of  $K_1$  and  $K_2$  are obtained as Eq. (11) and Eq. (12). Using the method shown in *Figure 4*, the values of  $K_1$  and  $K_2$  are obtained for the 118-bus network of 0.805 and 0.195, respectively, and the New England network of 0.9 and 0.1, respectively.

$$K_1 = \max\{K_m\} \quad \text{Eq. (11)}$$

$$K_2 = 1 - K_1 \quad \text{Eq. (12)}$$



**Figure 4.** Proposed method for determining the value of  $K_1$ .

***Load shedding using the proposed method***

In this section, the proposed decoupling method is applied to the IEEE 118-bus test network and the New England 39-bus network, and the results are compared with the

results obtained from the voltage sensitivity to active power method. *Tables 1* and *Table 2* show the results of load shedding using the voltage sensitivity method to the active power and the proposed method. According to the results presented in these tables, the method proposed in this paper, by selecting a more suitable bus to cut the load, prevents voltage drop and cuts less active power than the voltage sensitivity method to active power. Slowly the reason for the better performance of the proposed method lies in the fact that the proposed method cuts off more reactive power by properly selecting the bus bars for voltage loading, and as a result, the voltage profile is improved and the further voltage drop is prevented. For a more detailed review of the proposed method, the performance of the proposed method and the method of voltage sensitivity to active power in the IEEE 118-bus network will be examined in more detail. *Figure 5(a)* to *Figure 5(c)* shows the changes in reactive power cut off in the scenarios examined in *Table 1*. According to this figure, the proposed method cuts off the amount of more reactive power and changes the load selection process for load shedding. This is a change of direction in the direction that causes more reactive power to be cut off in the initial stages of load shedding and reduces the cut-off active power. In *Figures 6(a)* to *Figure 6(c)* and *Figure 7(a)* to *Figure 7(c)*, the voltage profiles of the buses after applying voltage load shedding using the proposed method and the method of voltage sensitivity to active power for the three outputs studied are shown in *Table 1*. Based on these figures, the proposed method and the method of voltage sensitivity to active power have been able to return the voltage of all busses above 0.9pu, with the difference that the proposed method with less active power cut-off of the bus voltage to Returned above 0.9pu. *Table 3* shows the IEEE 118 bus test frequency before and after the exit of the units and lines of *Table 1*. According to this table, the frequency of the power system after voltage decontamination in some cases is approximately one Hz with the nominal frequency of the power system (60 Hz), because in voltage decompression the goal is to improve the voltage profile and there is no restriction on the frequency. Voltage unloading is not considered. Therefore, a frequency load shedding power system must be activated to return the frequency to the normal range, which is not the subject of this paper. Frequency unloading can be performed by sub-frequency relays or frequency load shedding methods. Examples of frequency load shedding methods are presented in Amouzad Mahdiraji (2020), Lytvynchuk et al. (2019), Abedini et al. (2014) and Gu et al. (2014).

**Table 1.** Voltage load shedding using the proposed method and voltage sensitivity method active power in IEEE 118 bus network.

Disconnected lines and generators	Voltage sensitivity method to active power		Suggested method	
	Q (MVar)	P (MW)	Q (MVar)	P (MW)
Lines 82-77 and G25	239	586.3	266.1	557.8
Lines 65-38 and G26	155.67	281.47	127.65	239.35
Lines 100-94 and G85	279.00	738.50	388.54	276.10

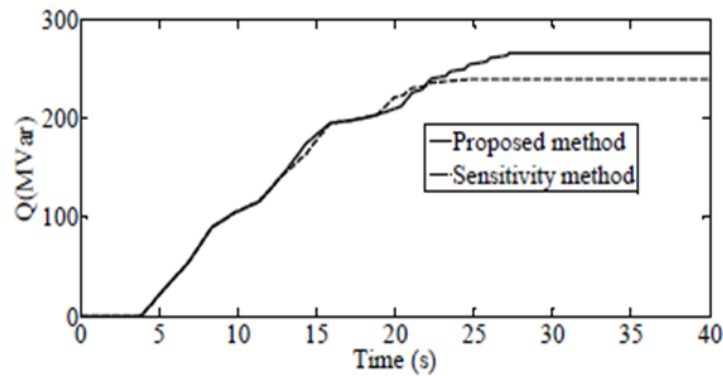
**Table 2.** Voltage load shedding using the proposed method and the method of voltage sensitivity to active power in the 39 bus network New England.

Disconnected lines and generators	Voltage sensitivity method to active power		Suggested method	
	Q (MVar)	P (MW)	Q (MVar)	P (MW)
Lines 11-10 and G2	142.2	198.2	305.6	557.8

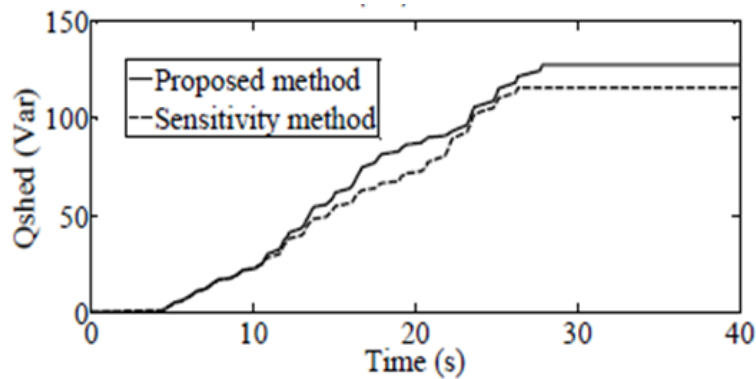
Lines 4-3 and G2	210.2	185.0	532.6	239.35
Lines 2-1 and G1	137.5	137.5	607.2	276.10

**Table 3.** IEEE 118 bus network frequency before and after load shedding using the proposed method and the method of voltage sensitivity to active power (in Hz).

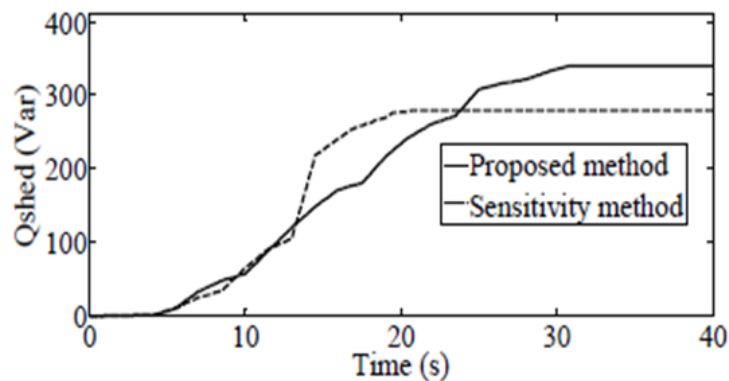
Disconnected lines and generators	Voltage sensitivity method to active power		Suggested method	
	Q (MVar)	P (MW)	Q (MVar)	P (MW)
Lines 82-77 and G25	60.87	60	60.81	60
Lines 65-38 and G26	59.82	60	59.77	60
Lines 100-94 and G85	61.26	60	60.94	60



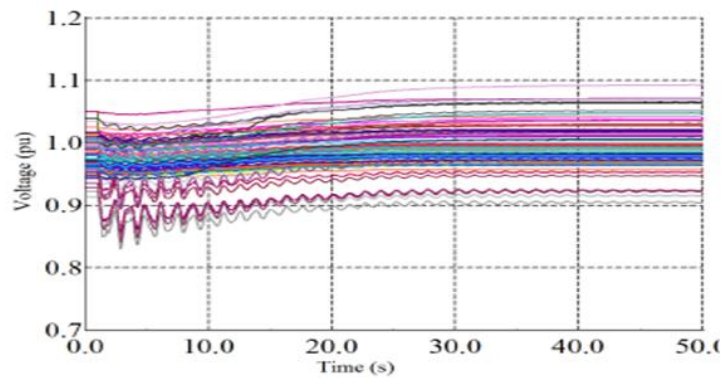
**Figure 5(a).** Changes in cut-off reactive power in voltage-sensitive methods for active power and a proposed 118-bus IEEE network test on exit lines 77-82 and G25.



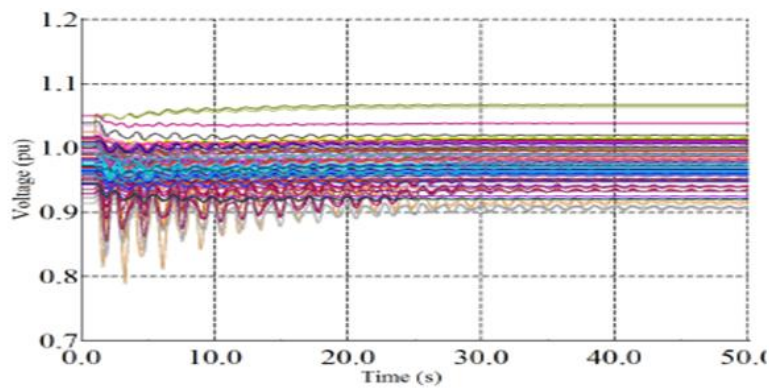
**Figure 5(b).** Changes in cut-off reactive power in voltage-sensitive methods for active power and a proposed 118-bus IEEE network test on exit lines 38-65 and G26.



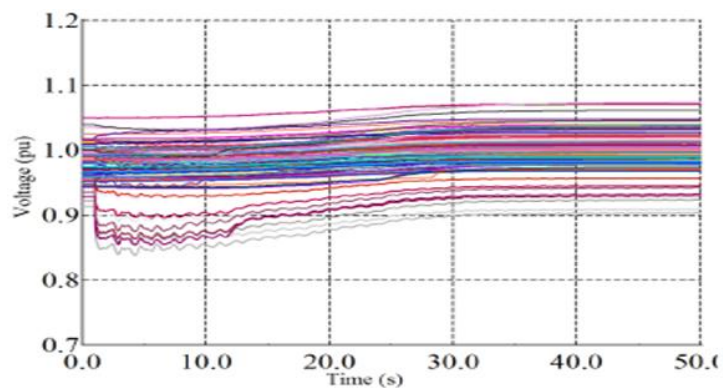
**Figure 5(c).** Changes in cut-off reactive power in voltage-sensitive methods for active power and a proposed 118-bus IEEE network test on exit lines 94-100 and G85.



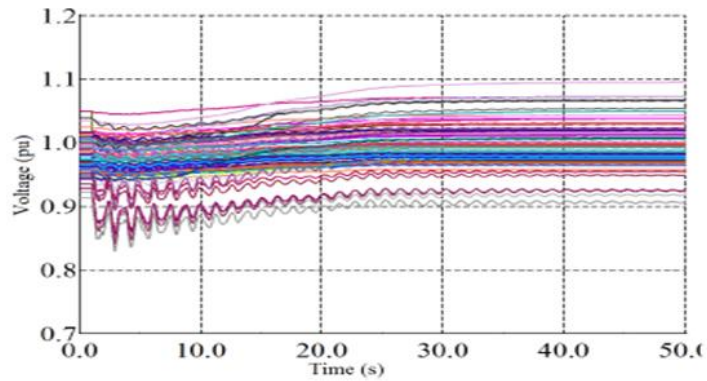
**Figure 6(a).** Voltage profile after load shedding with the method proposed in IEEE 118 bus network exit lines 77-82 and G25.



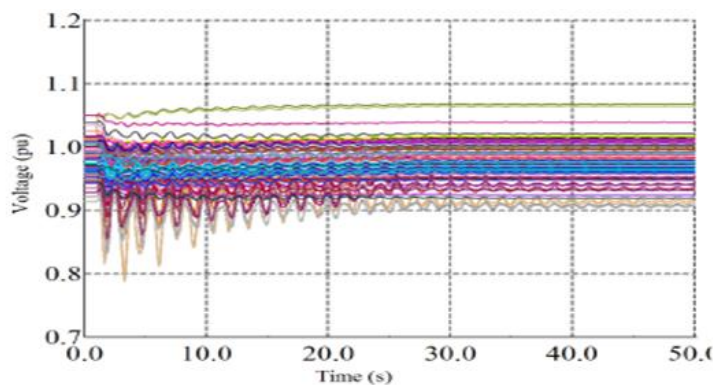
**Figure 6(b).** Voltage profile after load shedding with the method proposed in IEEE 118 bus network exit lines 65-38 and G26.



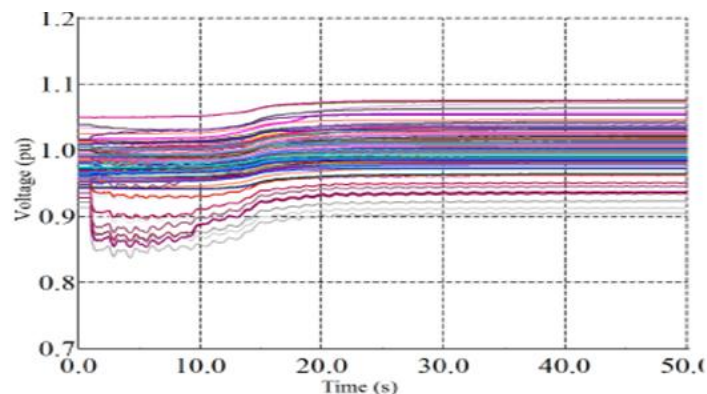
**Figure 6(c).** Voltage profile after load shedding with the method proposed in IEEE 118 bus network exit lines 94-100 and G85.



**Figure 7(a).** Voltage profile after load shedding by voltage sensitivity method to active power in IEEE 118 bus network exit lines 77-82 and G25.



**Figure 7(b).** Voltage profile after load shedding by voltage sensitivity method to active power in IEEE 118 bus network exit lines 38-65 and G26.



**Figure 7(c).** Voltage profile after load shedding by voltage sensitivity method to active power in IEEE 118 bus network exit lines 100-94 and G85.

### **Investigating the islanding of the system**

In some cases that occur in power systems, several devices may be deliberately derated and cause an island state in the network. To evaluate the performance of the proposed method in the case of islanding, it is assumed that lines 1-39, 3-4-3, and 15-16 in the New England network at times  $t=1s$ ,  $t=11s$ , and  $t=21s$ , respectively. As a result of the error, they are taken out of orbit, and as a result, the New England network is divided into two islands,  $S_1$  and  $S_2$ , as shown in *Figure 8*. The voltage profile of the New England grid after the islands is shown in *Figure 9*. According to this figure, the

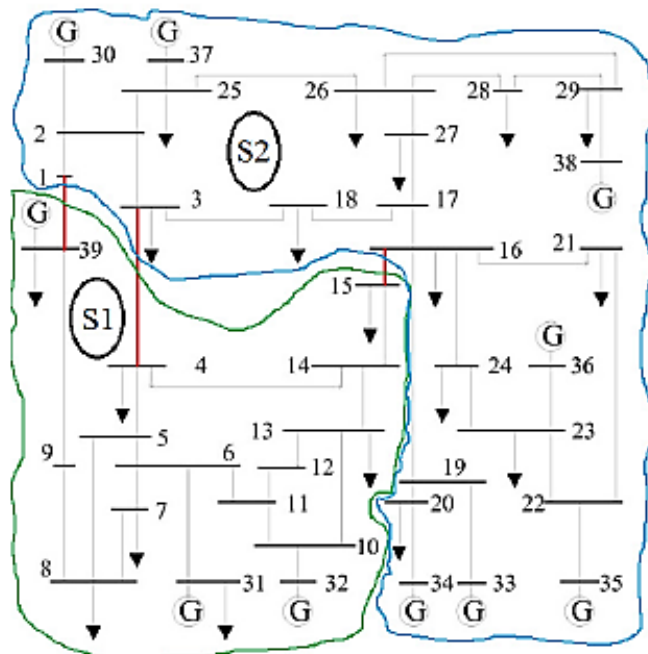
voltage of buses 12, 15, and 4 after the island of  $S_1$  is less than 0.9pu, and therefore, on island  $S_1$  the voltage must be deflated to return the voltage of the buses above 0.9pu. The amount of active and reactive power cut off to return the bus voltage above 0.9pu on the island of  $S_1$  is shown in *Table 4*. Also, the New England mains voltage profile after load shedding using the proposed methods and the voltage sensitivity to the active power are shown in *Figures 10* and *Figure 11*. According to *Table 4* and *Figures 10* and *Figure 11*, the proposed method has reduced the bus voltage above 0.9pu by lowering the active power. It should be noted that the voltage of the buses on  $S_2$  Island is higher than 0.9pu and therefore there is no need to perform voltage load shedding on  $S_2$  Island (*Table 5*).

**Table 4.** Voltage load shedding using the proposed method and the method of voltage sensitivity to active power in the New England network in the state of islanding.

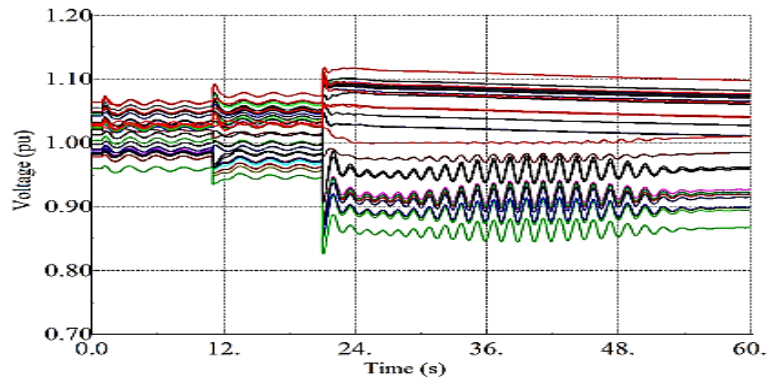
Suggested method		Voltage sensitivity method to active power	
Q (MVar)	P (MW)	Q (MVar)	P (MW)
108.30	385.00	130.70	336.00

**Table 5.** Frequency on two island  $S_1$  and  $S_2$  with and without voltage load shedding.

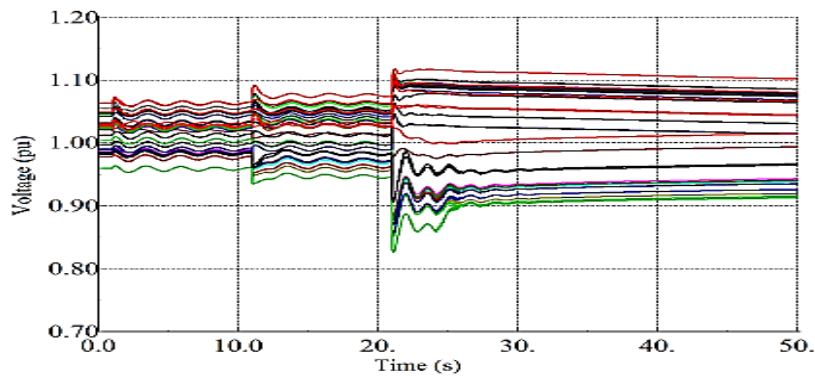
$S_2$ island		$S_1$ island	
With voltage load shedding	Without voltage load shedding	With voltage load shedding	Without voltage load shedding
61.40	61.40	58.76	57.81



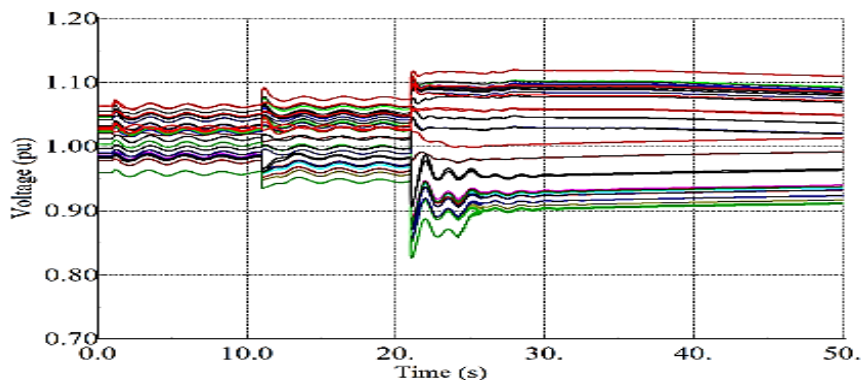
**Figure 8.** Formation of two island  $S_1$  and  $S_2$  in the New England network with output three lines.



**Figure 9.** New England mains voltage profile after islanding.



**Figure 10.** Voltage profile after voltage load shedding with the proposed method in  $S_1$  island.



**Figure 11.** Voltage profile after voltage load shedding by voltage sensitivity to active power method on  $S_1$  island.

## Conclusion

In this paper, a new voltage load shedding method is proposed. The proposed method, unlike the methods before voltage sensitivity to active power and reactive power, is often used to determine the appropriate bus to perform voltage load shedding. Also, the proposed load shedding method does not use intelligent optimization methods, and as a result, the time required to implement the proposed method is short enough and can deal with short-term voltage instability. Another feature of the proposed method is the ability to consider the effect of dynamic equipment such as motors and tap changers,

because this method is fast enough and receives the information it needs from PMUs. The simulation results showed that the proposed method cuts off more reactive power in the initial stages of voltage load shedding and requires less active power cut off than the voltage sensitivity method compared to active power. To model the delay due to computations in the control center and the delay due to sending information by PMUs, a method was introduced in the Digsilent software using DPL capability.

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### **Conflict of interest**

The author(s) confirm that there are no conflict of interest involve with any parties in this research study.

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