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# Establishment and Optimization of Security Domain Prevention System in Business Middle Office Based on Choquet Expectation



**Abstract:** - With the rapid development of China's national economy, the needs of People's Daily life are increasing, and the demand for various business middle platform security domain prevention is also increasing. At the same time, due to the imbalance of its own resource allocation, it shows the characteristics of "more resources and less load" in the western region. With the gradual popularization of the application of Choquet expectation, a large number of new Choquet expectation algorithms have been incorporated into the security domain prevention system of the business middle platform, and have entered thousands of households. This kind of distributed generation also has its own problems such as difficulties in grid connection, large amount, small environmental pollution, flexible operation mode, and prominent stability problems. Factors such as the interconnection of large-area services, long-distance transmission of AC and DC UHV, and marketization of services make the topology of services more complicated, and the steady-state operation of Choquet services is also closer to the critical stable operation point. At present, the security domain prevention of China's business middle office has become a serious problem. In recent years, there have been several large-scale business middle office security domain incidents around the world. A comprehensive study of the above business middle platform security domain prevention events shows that when the business load is heavy and the business is complex, when the business has a large fault, it will lead to the chain short circuit of the business and serious economic damage. Therefore, combining Choquet expectation to quickly and accurately consider the stability of the service, and combining the new energy characteristics, especially the characteristics of Choquet expectation, is the main problem and problem of the security domain prevention market in the future business.

**Keywords:** Choquet expectation; business middle platform; security domain prevention; system optimization.

## 1. Introduction

The stability of the security domain prevention system in the business middle platform is that the system can still maintain its stable work under its normal working conditions or continue to work after being disturbed. The stability of the system is constrained by many factors such as disturbance type and location, system topology, and load size and type. Due to differences in Choquet expectation criteria, there are many ways to partition the stability problem of services. In the process of research, the stability problem is divided into: short stage and long (medium) stage. From the point of view of Choquet expectation system  $\Rightarrow$ , the stability of Choquet expectation can be divided into: small disturbance and large disturbance. Among them, the dynamic characteristics of the business middle office are dominated by linear dynamics, while the dynamic characteristics of the business middle office are based on nonlinear dynamics. When analyzing the stability problem, it is divided into three categories: frequency stability, voltage stability and power Angle stability.

At the same time, the working condition of the synchronous service middle platform in parallel operation will also affect the transient stability of the service. In modern services, large capacity long-distance transmission, its instantaneous stability problem is of great significance. From the system point of view, instantaneous stability refers to maintaining the synchronization performance of the parallel service middle stage when the service is subject to large interference. Mathematically speaking, transient stability is a class of problems with highly

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nonlinear and high-dimensional properties. At present, there are two main evaluations of instantaneous stability at home and abroad: qualitative and uncertain. Among these methods, there are several determined analytical means such as numerical simulation, transient energy function, and artificial intelligence. These methods mainly include interval operation, sequence operation, credibility, fuzzy theory, probabilistic insecurity index, etc.

Based on the dynamic safety calculation proposed by Choquet expectation, it is divided into six categories from the perspective of transient stability [1-4]:

### **1.1 Choquet's expected applicability in the business middle office**

The Choquet expectation technique has high reliability and applicability and is not limited to the model. In general, the working condition before the disturbance is taken as the starting condition, and the differential algebraic equation is established between the Choquet expected system structure and the service middle platform and the load pattern. This equation has been solved by numerical integration, generally using alternating and joint solutions. Thus, the relation curve between the state quantity and the number of generations of the system after the fault occurs is obtained. According to this, it is judged to be stable, so as to control it.

However, this Choquet expectation algorithm has some disadvantages such as high computational cost and high computational complexity. Moreover, as the complexity and dimensionality of the target network increase, the required network takes longer and longer time. Therefore, the algorithm is suitable for parsing and planning offline and cannot be used for online applications [5-6].

### **1.2 Optimization of the security domain prevention system expected by Choquet**

This method provides a new method for the stability analysis of business. The key of this method is to use various theories to train a large number of offline samples, extract the feature quantity, and construct the classification machine according to the accuracy required. Among these algorithms, the most representative is the neural network, which is able to process a large amount of data at the same time, as well as adaptive learning, and establish a nonlinear mapping, identification and classification. In terms of dynamic safety, it can quickly judge the safety of failure and grade it.

### **1.3 Establishment and improvement of the prevention system in the security domain of the business middle platform**

The key to Choquet expectation is Lyapunov's stability criterion. This criterion was first proposed in 1982, and soon it was widely used in various projects. The core of the algorithm is to construct a reasonable energy function formula suitable for various objects, and the calculation formula of the critical energy is given. The energy function model of power systems was first proposed by Pai et al. in 1970. Under the continuous improvement of later researchers, this method is becoming more and more perfect. Athay et al. studied the relationship between the transmission conductivity and the failure point. The potential energy interface method was proposed by Kakimoto et al. Jiang et al. improved the potential energy interface method and established the Choquet expectation method based on it [7-9].

According to the different requirements and details, the system modeling is divided into traditional mode and structured mode. In the traditional model, only the nodes inside the service middle platform are analyzed, and the topology of the network is maintained on the basis of maintaining the structure. Based on the key energy of the track and the interaction between the tracks, it is divided into track independent and track associated.

### **1.4 Choquet expected expansion equal area method**

The equal-area method is a typical quantitative method for the dynamic stability of nonlinear systems. Using the formula of unbalanced power and rotation Angle, it can intuitively reflect the change curve between the safety domain prevention and the rotor Angle of the infinite unbalanced business of a single unit. The acceleration region and the landing region are compared, and if the acceleration region is larger than the landing region, then the system is unstable. If the acceleration region is smaller than the reducer region, then the system becomes smoother. The algorithm has the advantages of clear physical meaning and fast operation. However, it also has obvious defects, that is, it cannot analyze the stability of multiple pendulons for multiple robots.

Xue Yusheng et al. solved the above problems by introducing the equal area method into EEAC. In this method, the CCCOI-RM conversion is used to divide the multi-machine control system into advanced type and lagging type, and then converted into a single infinite large scale. The algorithm is applied to extend multi-machine control. In the study of Xue Yusheng et al., different transformation methods such as Choquet expectation transformation are also given respectively. According to the characteristics of multiple computers, multiple computers are equivalent to two computers [10-14].

In the study of multi-pendulum stability, the extension of the equal-area method still has shortcomings, and under the non-homology phenomenon, the equal-area method is used for equal-value analysis, and the results have great deviation. To solve this problem, some researchers suggest using the equal value method of three machines, but the results are not obvious.

### 1.5 Choquet expected to promote the establishment of prevention system

Choquet expectation is a transient stabilization of a single-machine infinitesimal algorithm based on infinitesimal. When the Choquet expectation method is studied in depth, the OMIB method must be studied in depth. In OMIB, different tuning groups are divided into early and late groups, and then converted into a single infinite group. OMIB systems can generally be divided into time-varying, time-varying, and general-purpose systems.

The Choquet expectation (one-machine equivalence) method uses the CCCOI-RM transformation (CCCOI-RM). Transform a multi-computer system into two computers, and transform it into an infinite single computer. It has an infinite candidate cluster of individual units and an index to quickly determine stability and instability. On this basis, an infinite unit group based on clustering principle is proposed, that is, after each fault is removed, according to the number of time steps, the clustering method, storage method and update the existing single infinite unit group at each stage are decided. The set of all single infinite single units is called the infinite unit unit. In any infinite unit, the simulation is terminated in the simulated time domain under the condition that any infinite unit reaches stability or instability.

### 1.6 Dynamic safety domain approach for Choquet expectations

Various major power outages in recent years have shown that there is an increasing demand for real-time monitoring, monitoring and planning of services. The commonly used dynamic stability calculation is a point-by-point approach, while both the simulation and the energy function are computed point-by-point. This algorithm is only suitable for specific stability calculation under specific events and conditions. If anything changes, a stability assessment must be performed. This method can not fully reflect the stability of the whole system, nor can it fully evaluate the security of the whole system. Based on this, many researchers have introduced the concept of domain. This algorithm is different from point by point analysis. Under certain circumstances, this algorithm can make a specific system maintain its stability in a specific event. Obviously, the algorithm is convenient for network application and can evaluate the stability of the whole system. It facilitates online evaluation, optimizes control, optimizes the impact of uncertain factors, and optimizes constraints. One of the classic domains is a dynamic security domain [15-16].

## 2. Research methods

### 2.1 Definition of the dynamic security domain of Choquet's expected system

Assuming an error in the target system, Choquet expectation assumes that the failure duration is zero, and that the failure occurs at zero point. In the case before failure, this is the case at the time of failure, and after the accident, this is the case. The system pattern of these three stages can be expressed by formulas.

$$\begin{aligned}\dot{x}_0 &= f_i(x_0, y) & -\infty < t < 0 \\ \dot{x}_1 &= f_F(x_1, y) & 0 \leq t < \tau \\ \dot{x}_2 &= f_j(x_2, y) & \tau \leq t < +\infty\end{aligned}\quad (1)$$

On the basis of Choquet expectation, it is represented by the vector of system state variables before the failure, by the vector of state parameters after the failure, by the vector of state parameters of the system, by the input of active and reactive power of the system, and by the moment of fault removal.

In the usual case, equation (2-1 a) describes the power flow equation of the system; (2-1 b) describes the dynamic equation of the failure state from instantaneous to instantaneous; The formula describes the dynamic equation in the case after exclusion. By analyzing the experimental data, it is proved that when the stability value of the system is given, the bounds on transient stability and its stability are unique.

The criterion for Choquet expectation determination is: when the initial state after failure is in the inside of the system, the stability of the system is expressed. At this point, the orbits of the system will converge at the final equilibrium position. If the initial state after failure is outside, the system is unstable. At this time, the operating orbit of the system will necessarily not converge at equilibrium.

A set of injection points with steady state energy defined by the stability criterion is used as the safety zone of a dynamic. Since the inertia of the business middle platform is constant, therefore, the system of the target is an inertial, so there is no sudden change in the mechatronic control.

The experimental results show that due to the increase of the number of nodes and load in the target system, the amount of calculation of the fitting method increases greatly, and there are a large number of dimensional disasters. Due to the long time, the fitting method is not suitable for real-time operation, only for offline and online cases. So, scholars began to linearize the hyperplane. This is the basic analysis. The analysis method assumes that a slight change in the input energy is likely to affect the operation status of the security domain prevention system in the business middle platform. In the process of partial derivation of hyperplane parameters, the method of state quantity partial differentiation must be used. Among the three phases, the transient energy function of each phase has less influence on the injected power.

Here's how it works:

1) For a specific target system, establish a set of parameters including network topology, failure location, failure type, exclusion time, failure resistance, etc.

2) Through the analysis of the experience and instantaneous stability of the business middle office security domain prevention system, the key value of an effective business middle office security domain prevention system is obtained, and it is used as a reference for this method.

3) Using the relationship between the factor vector and the normal vector of the hyperplane, the linearization of the factor of the hyperplane at the fiducial point is obtained.

The key of the algorithm is through the study of the relationship between the parameter vector and the normal vector, and through the small interference method to solve the sensitivity of each parameter to energy. Based on this, a specific structure preservation mode is proposed.

Structure preserving patterns in analysis methods:

The analysis method adopts a more detailed structure maintenance mode: the number of business middle platforms is, the number of nodes is, and the number of nodes is:

$$J_I = \{1, 2, \dots, n_g\} \quad (2)$$

$$J_T = \{n_g + 1, n_g + 2, \dots, n_g + n_g\} \leftarrow \quad (3)$$

$$J_L = \{n_g + n_g + 1, n_g + n_g + 2, \dots, n\} \quad (4)$$

$$J = J_I \cup J_T \cup J_L \quad (5)$$

## 2.2 The formula for calculating the Angle of the center of inertia at different angles is obtained by using the Choquet expectation transformation

The experimental results show a large difference between the expected hyperflatness of Choquet and the hyperflatness of the load. The power access point and load access point are regarded as one class by the analytical method, but the hypersurface parameters obtained by this method are very different from the fitting results. At the same time, there is a great correlation between the homology characteristics of the business middle platform and the hyperplane factor obtained by the analysis method. According to the homology characteristics of the unit, it is divided into several units, and it is divided according to the characteristics of its load. More accurate hyperplane parameters can be obtained by increasing the threshold number of reference active power injection vectors.

This chapter mainly expounds the basic idea and basic solution method of Choquet expectation basic, and describes it. Its characteristics are pointed out: there are no caves in the safe area, no islands or ropes outside the area. The edges of this region can be approximated by a collection of several hyperplanes. In Chapter 2 of this paper, we propose a criterion for determining stability, that is, when a particular failure object, a set of business middle safety domain prevention injection points are in a dynamic safety zone in a dynamic safety zone. If is outside a dynamic safe zone, then the point is a dynamic safe zone.

The Choquet expected hyperplane is used to approximate the dynamic safe region, and a new algorithm is given to solve the dynamic safe region. Furthermore, a solution based on fitting and analytical methods is proposed. In this paper, the various modes of the fitting and analysis methods are introduced in detail, and the specific derivation and derivation of them are carried out. Among them, the fitting method mainly uses the binary method to find the effective effective power threshold in a certain search direction through the method of quasi-orthogonal selection. When the required number of critical energy points is met, the least squares method is used to fit them. This method has high accuracy and good stability. However, this algorithm has a large amount of calculation and slow operation speed, and is only suitable for offline and online use. To this end, some modifications are made to the analysis method in this paper. It only uses the active power input point at one input as the reference point. Before and after the failure, the disturbance method is used to analyze it, and its influence on the security domain prevention system of the business middle platform is obtained, and it is transformed into the stability equation. This method is fast, but its accuracy is poor. Later researchers made further improvements to this method and proposed to divide the units into different groups according to the same tonality and voltage characteristics of the load. The accuracy of calculation is improved and the number of benchmark critical power points is increased.

## 3. Result analysis

### 3.1 Choquet expects comprehensive security domain prevention for the business middle office

Choquet expectation is a transient stabilization of a single-machine infinitesimal algorithm based on infinitesimal. In order to better analyze the Choquet expectation, the OMIB method must be studied in depth. The OMIB algorithm divides different tuning groups into leading and lagging groups, and then transforms them into a single infinite large system. OMIB systems can generally be divided into time-varying, time-varying, and general-purpose systems.

The essential difference between EEAC and Choquet expectation is: EEAC algorithm is a typical secondary network topology using secondary service middle and network structure, using parameters at the instant of

failure. This method is very simple and very fast. Its basic assumption is that the service middle platform has a strict co-modulation property. In this scheme, the time-varying OMIB architecture is adopted, which reduces the strict homology restriction on the cells, and also adopts a more accurate architecture. Its power equation is expressed by the formula:

$$M\ddot{\delta} = P_m - P_e = P_a \tag{6}$$

Among them, the inertia of the business middle platform, the mechanical force of the business middle platform, the electromagnetic force of the business middle platform, and the unbalanced business middle platform safety domain prevention.

### 3.2 Two assumptions of Choquet's expectation method in security domain prevention systems

The stability characteristics of UEP-1 show that the stability of this system is the stability of two vehicles. That is, in the target service middle security domain prevention system, the service middle security domain prevention system in the service middle security domain prevention system is divided into two parts, one of which is the pilot system (CM) and one delay system (NM). From this, the transient stability of multiple machines can be obtained from two separated clusters.

The instability of an infinite system with a single unit is studied by using the EAC method. The rotor Angle equations for the OMIB pioneer cluster and delay cluster are as follows.

$$\delta_N(t) = M_N^{-1} \sum_{K \in N} M_K \delta_K(t) \tag{7}$$

Through the comparison of different algorithms, the advantages and disadvantages of different algorithms are obtained, and it seems that there is an uncoordinated conflict between the accuracy of the algorithm and the operation speed. Through the detailed analysis of each step, we can see that the conventional dichotomy is a drawback. These two methods use the secondary analysis method to solve the key points of active power injection in a certain direction. Moreover, in a single optimization process, the time domain simulation is included. This method has a high time consumption capability in the time domain, and can provide enough relevant knowledge such as stability and dynamic changes of stability. Binary can't make full use of this kind of data, it only uses a fixed 0-1 data, this will cause a lot of resource consumption, and does not have good results. On this basis, a new dynamic secure domain algorithm is proposed. For a specific search direction, a linear linear model based on OMIB is constructed and related to the power input of OMIB.

The Choquet expectation algorithm is used to solve the mechanical critical points of the OMIB system, which has the advantages of fast and rapid calculation results. Using the classical second-order model, the internal node equation is formulated as follows.

$$\begin{aligned} \dot{\theta}_i &= \omega_2 \\ M_i \dot{\omega}_i &= P_{mi} - f_i(\theta, V) - \frac{M_i}{M_T} P_{cor} \quad i \in J_I \end{aligned} \tag{8}$$

Where, describes the mechanical input power of, describes the inertia constant of, describes the relative angular velocity with reference to the center of inertia, and.  $P_{mi}$   $M_i$   $\omega_i$   $P_{cor} = \sum_{i \in I} P_i$  Reason:

$$\begin{aligned} \dot{\theta}_g &= \omega_g \\ \dot{\omega}_g &= -M_g^{-1} T_1 (f(\theta_g, \theta_i, V) - P(V)) - e_g \left( \frac{P_{cor}}{M_T} \right) \\ 0 &= T_2 (f(\theta_g, \theta_i, V) - P(V)) \\ 0 &= g(\theta_g, \theta_i, V) - Q(V) \end{aligned} \tag{9}$$

Type,

$$\theta_g = [\theta_1, \theta_2, \dots, \theta_{n_e}]^T \tag{10}$$

$$\theta_l = [\theta_{n_e+1}, \theta_{n_e+2}, \dots, \theta_n]^T \tag{11}$$

$$\theta_\omega = [\omega_1, \omega_2, \dots, \omega_{n_e}]^T \tag{12}$$

$$M_g = \text{diag} \{M_1, M_2, \dots, M_{n_F}\} \tag{12}$$

$$V = [V_{n_R+1}, V_{n_R+2}, \dots, V_n]^T \tag{13}$$

Using this property, this nonlinear graph is numerically evaluated using a modified Newton method, and its convergence rate is almost quadratic. The search of transient stability margin is added at the critical time, which overcomes the disadvantage of 0-1 and greatly speeds up the operation efficiency of dynamic safety zone.

Choquet expectation is a combination of temporal simulation and direct methods combined with the dynamic security domain. Through the research of the existing dynamic security problems, it is pointed out that the inefficiency of the binary algorithm is its deficiency. In order to solve the injection point problem effectively, it is necessary to speed up the operation rate of the dynamic security domain and expand its applicable field, so that it can deal with all kinds of online computing problems well, and expand the application field of the injection domain in a sense.

A nonlinear relationship between power outputs based on the conversion of multiple machines to a single machine is proposed. The mapping combines two dynamic security evaluation techniques, namely the preventive injection security domain and the dynamic Choquet expectation. At the same time, the algorithm can further improve the binary model, it can introduce the stability margin into the preventive injection vector in the critical business middle platform security domain, so as to establish the practical way of n-dimensional vector value and threshold point.

This graph is built by treating each generator as load equivalent. The implementation of this method makes the scheme more reasonable and comprehensive. Therefore, the obtained hyperplane is more accurate. In order to verify the various mechanical properties of the OMIB system in practical applications and the relationship between each unit and the load, there is no obvious difference in the accuracy of the final critical power injected into the space. That is, if a specific exile pattern is not taken into account, then the critical energies are not negatively affected in any way. The results show that the difference between the three instances lies in the difference of the units and the loads involved.

The second example uses two CASE methods to illustrate the speed, efficiency and accuracy of the method from three aspects. Experimental results show that the proposed method is only about 8% of the conventional binarization method. The experimental results show that the maximum power point calculated by Choquet expectation method is much larger in the rate of one side approach than the rate of two sides approach. Finally, an example is given to show that the dynamic security of the system can be further improved by using Newton's method.

#### 4. Conclusion

In this paper, the basic concept of Choquet expectation is mainly expounded, and the probability distribution of each factor of Choquet expectation is studied in detail. The uncertainties mainly include: ground resistance, fault type, fault time, fan output power uncertainty, load uncertainty, fault point, etc. Combining the above random factors, the reliability evaluation model of the service is established, which provides more complete data for the operation of the service. The hyperplane equation of the dynamic safety zone is combined with two properties, that is, the boundary spacing is linear under different failure moments, and the expression form of the probability insecurity exponent of the fourth integration is simply deduced. The mathematical model of uncertainty of wind power system and load is established. Assuming that the load volatility of wind power generation is low relative to the business middle platform security domain prevention system, the safety zone of the existing business middle platform security domain prevention system will not be affected. From the dynamic and static safety zone hyperplane factor analysis of the safety domain prevention system in the middle of the business, it can be seen that the output power of the wind turbine and the binding force of the shear machine are straight. When the load changes greatly, its load capacity is linearly related to the load nodes that have been cut out. According to probability theory, it is convenient to obtain the relationship between the cutting machine capacity and the cutting load capacity. The calculation method of expected loss is modified accordingly. By introducing the above method into the calculation formula of the insecurity index, it can be made to have higher reliability and applicability in the selection and classification of failures.

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