Research on Economic Evaluation Model of Agricultural Machinery Drive System Overhaul Based on Effect Coefficient Method

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Abstract: Agricultural mechanization is the main driving force for the development of agricultural modernization. Agricultural machinery and equipment systems are an important part of agricultural mechanization. In the development of agricultural mechanization, the study of agricultural machinery systems is an inevitable focus. It is essential to fully grasp the internal characteristics, structure and operation rules of agricultural machinery systems, and to optimize the application of agricultural machinery and equipment in agricultural production practices and to improve the technical and economic benefits of agriculture. However, the agricultural machinery system is a very complex system.

Introduction

Electric vehicles are mainly used for transportation, but the commonly used agricultural small tractors are not only used for road transportation but also have to perform heavy farm operations such as ploughing, tilling, and rotary tillage. Since the environment and load of each working condition of the tractor are different, each working condition also has different requirements for its performance. However, in general, high-load operation is a common feature of tractors when carrying out ploughing, rotary tillage and other heavy farm operations. When analyzing the pure electric tractor drive system, it is impossible to analyze each working condition. Therefore, it is necessary to select the common features of each working condition for corresponding analysis and design, so that the designed drive system can meet the requirements of various working conditions. There are certain problems in the evaluation of penetration enhancers by using gray correlation clustering method, power function method, fuzzy matter element and new gray correlation analysis method. Therefore, the effect coefficient method was used to comprehensively evaluate the penetration-enhancing effect of the penetration enhancer, in order to provide a new evaluation tool for the study of drug transdermal preparations. The smaller the effect value is, the larger the effect weight is, and the smaller the system disorder is. Therefore, the information entropy theory can be used to evaluate the order degree of each index and its utility, that is, the judgment matrix composed of the evaluation index values to determine the weight of each evaluation index.

Agricultural Machinery Drive System

The agricultural machinery system is mainly composed of various agricultural machinery and equipment, which is composed of various power machinery and working machinery required in agricultural production practice. The agricultural machinery system can be divided into several interconnected subsystems. The agricultural machinery is divided into several categories according to different functions and models, each of which is a subsystem. The agricultural machinery models in the same type of agricultural machinery are the same. The agricultural machinery in the same category can play an equivalent role in specific agricultural production practices, but different. There is a certain connection between the agricultural machinery and the order of the agricultural production process, which affects each other. In the agricultural machinery subsystem, the change in the number of agricultural machinery and the distribution of its age are directly affected by the scrap rate, renewal rate

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and disturbance factors of agricultural machinery.

Agricultural machinery refers to the various machinery used in crop planting and animal husbandry production, as well as in the initial processing and processing of agricultural and livestock products. Agricultural machinery includes agricultural power machinery, farm construction machinery, soil tillage machinery, planting and fertilizing machinery, plant protection machinery, farmland irrigation and drainage machinery, crop harvesting machinery, agricultural product processing machinery, animal husbandry machinery and agricultural transportation machinery. The agricultural machinery in a broad sense also includes forestry machinery, fishery machinery, and rural side machinery such as sericulture, beekeeping, and edible fungi cultivation.

After determining the overall scheme and performance evaluation indicators of the pure electric tractor drive system, before the parameter design, the component types of the drive system must first be matched. The drive motor is its “heart”. There are many different types of drive motors on the market. Different types of drive motors have different performances for different occasions. Therefore, it is important to select the most suitable drive motor for pure electric tractors. At present, there are four main types of drive motors commonly used in electric vehicles: DC motors (DCM), induction motors (IM), permanent magnet brushless motors (PMBM), and switched reluctance motors (SRM), each with its own specific Advantages and disadvantages. The main performance comparison of common drive motors for electric vehicles is shown in Table 1.

Table 1 Comparison of Main Performance of Commonly Used Drive Motors

Attribute	Motor type			
	DC	Induction motor	Permanent magnet brushless motor	Switched reluctance motor
Power density	Low	Medium	Tall	Medium
Torque	Small	Medium	Big	Medium
Service life	Short	Long	Relatively Long	Long
Noise/vibration	Big	Small	Small	Big
Torque fluctuation	Strong	Weak	Weak	Strong

DC motors have a long history. It was applied to electric vehicles as early as the beginning of the 20th century. It has mature technology and high torque at low speed acceleration. It can be directly connected to the vehicle’s power battery pack. And the speed adjustment is regulated by voltage change, no complicated controller is needed, the control is simple, and the electromagnetic torque control characteristic is excellent. However, there are also several disadvantages: 1) Power supply to the armature requires mechanical commutators and brushes, both of which are very susceptible to friction at high speeds and unreliable for frequent maintenance; 2) It is not advisable to work in a dusty or humid environment; 3) Low power density, large volume, and high price. Induction motors not only have the advantages of strong structure, low cost, small size, high reliability, wide speed range, etc., but also have good dynamic performance in complex environments, and have higher power density and efficiency than DC motors. However, due to the inherent rotor loss, the power density and efficiency are not as high as that of the permanent magnet brushless motor, which is relatively low.

Digital Economy Evaluation Model

From a macroeconomic perspective, a more common approach is to model data. At present, there are some common digital economic evaluation models, such as the digital economic model of the Institute. The model consists of two parts, one is the added value of the information industry, and the other is the integration of digital technology and other industries. The model launched by Tencent's China Internet + Index consists of four parts: the basic sub-index, the industrial sub-index, the double-innovation sub-index, and the smart livelihood sub-index. The data is composed of its basic mobile internet product data and Tencent cloud data. The above digital economic evaluation model is based on the macro understanding and grasp of the digital economy by various organizations. The establishment of the formula is based on the digital economic industry content or the main form of the digital economy. Below, based on the author's understanding of the digital economy, a digital economic evaluation model is constructed.

(1) The digital economy presents a "centralized" development trend

Digitization is the most basic feature of the digital economy. In the digital economy, the collection, transmission, processing and application of data has become its core format. Therefore, enterprises and regions with data sources and related formats will have a central position in the development of the digital economy.

(2) The digital economy presents a "borderless" development trend

In the era of digital economy, with the wide transfer, sharing and application of data, the extension and integration of the digital industry, as well as the formation of digital requirements and applications will be ubiquitous, and the impact of the digital economy will present a state of being borderless. Even if there is a boundary at a certain stage, the boundary can be broken, blurred, or even disappeared. This kind of being borderless is mainly manifested in two aspects: one is vertical without borders, and the other is horizontal without borders.

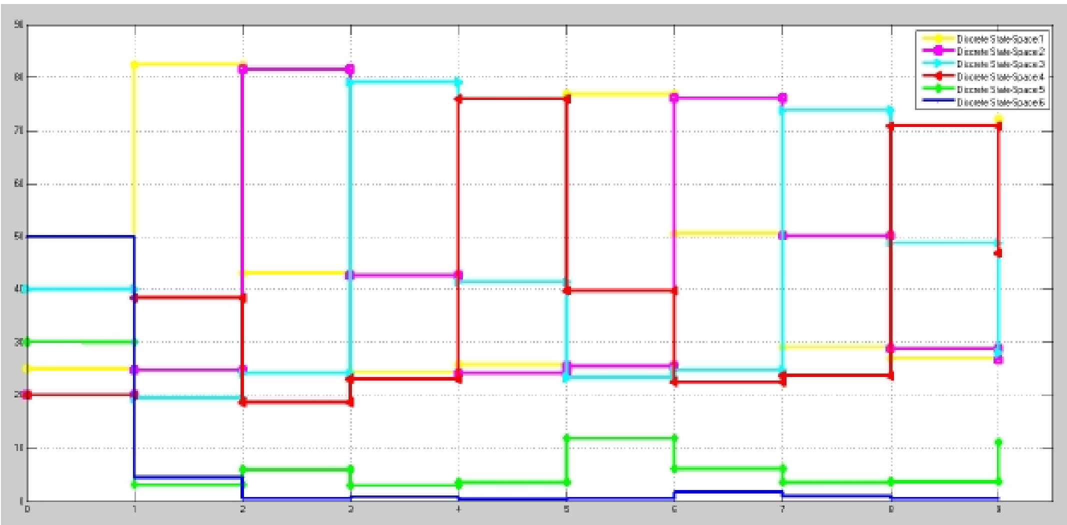

Figure 1. Image Output Result

Figure 1 is the image output result. Wherein, the ordinate indicates the number of agricultural machines, the abscissa indicates the simulation time, and the different broken lines indicate the agricultural machines corresponding to the same model and different ages. From the output results of the above two figures, the distribution and quantity distribution of the age structure of the agricultural machinery in the agricultural machinery subsystem at n=9 can be obtained intuitively. Different control output results can be obtained by changing the manual input of the simulation model. According to the above-mentioned constructive and controllable agricultural machinery subsystem control model and simulation model, the control and simulation of the whole agricultural machinery system can be realized by analogy. Through the operation of the simulation model, the state change of the agricultural machinery system can be quickly obtained, and the effectiveness of the agricultural machinery subsystem control model is verified.

Feasible Solution Optimization Design

After a preliminary study of the feasible scheme, several applicable foundation pit support type schemes can be obtained. The next step is to optimize the design of each feasible scheme, including the support pile diameter and pile spacing, anchor or support point. The location and number of layers. The goal of the optimized design of the feasible scheme is to minimize the cost of the foundation pit support scheme. The constraints include the limitation of the maximum displacement of the pile top and the requirements of the support position.

Compare and select all optimization options. At present, there are two main evaluation methods for deep foundation pit support schemes: (1) The qualitative analysis method is used to evaluate and compare each scheme. The personal experience of engineers, geotechnical experts, or the experience and lessons of previous engineering cases can help decision makers make faster and more scientific choices for alternatives. (2) The program was evaluated by a combination of qualitative analysis and quantitative calculation. In recent years, fuzzy comprehensive evaluation method, comprehensive value coefficient, system engineering theory and analytic hierarchy process have obtained a lot of research and application in the optimization of deep foundation pit support scheme. This paper refers to the concept of value engineering and evaluates the feasible solutions by calculating and comparing the value factors.

Conclusion

The research object of this paper is a small pure electric tractor. The engine power is relatively small, and the volume and quality of the whole vehicle are not large. Compared with heavy-duty tractors, it is mainly used for light-load farm operations, such as flat small plots, greenhouses and highways. The common feature is the traction of agricultural implements for plowing and other operations. Therefore, this paper selects the working conditions of the plowing operation to analyze the force because the analysis in this paper does not consider the slope resistance and air resistance. Starting from the connotation of the green economy, a multi-angle and all-round comprehensive evaluation is carried out in a targeted manner, in order to obtain more reliable evaluation results. It also makes effective judgments on the “bottleneck factors” that affect the green economy development of each evaluation object; and then provides valuable reference for effective adjustment and planning of “bottleneck factors” for green economy development in various regions.

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