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Design simulation and noise signal analysis of circuit breaker with selective over current protection

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ABSTRACT

An over current protection circuit breaker with selective protection is designed in this paper. We carry out motion simulation for the whole mechanism based on ADAMS. We observe and analyze the feasibility of the motion of the mechanism. And then the motion curve of important parts and the contact force curve of the important contact area and the curve of the force and torque of the spring are obtained. We have carried on the noise signal analysis to these curves by signal processing method, the computation and the simulation result show that the mechanism simulation conforms to the design expectation, through the simulation and signal analysis result we can find that the area where contact force is larger and the material of it needs to be strengthened. At the same time, the stiffness coefficient of each torsion spring and tension spring is different. The simulation results can provide the selection and matching of the coefficients of the spring and the torsion spring in order to ensure the reliability of the motion mechanism, accurate and stable. Overall, this product has no significant impact on the whole body.Through signal analysis, we find that its motion is stable andits design is reasonable.

Keywords: breaker; motion simulation; product design

1. INTRODUCTION

Domestic distribution terminal means selectively protection is the rated current and protection characteristics to match the way (also known as energy cooperation), the fault current is slightly larger than a certain value of the energy grade trip will not reach the selective protection the requirements, affecting the stability and reliability of system operation. MCB FTB1 with selective protection, with high breaking capacity precise selective protection, will be widely used in the power supply system.

2. PRINCIPLE

FTB1 having a short delay, long delay overload protection MCB. FTB1 (SMCB) + MCB with full selectivity works as follows:

When the terminal distribution system subordinate MCB branch short circuit current reaches a certain value, the higher the electromagnetic mechanism is operated main switch of the main circuit contacts SMCB repellent open, short-circuit current is switched rapidly to the secondary circuit, while the flow due to the current limiting resistor limits , short-circuit current is limited to a small value. At this point, if the lower MCB normal breaking short-circuit current, FTB1 (SMCB) will be re-closed main contacts return to normal working condition, so as not to affect other subordinate MCB branch of electricity, in order to achieve full selective protection. Figure 1 FTB1 Schematic three-dimensional modeling and product FIG.

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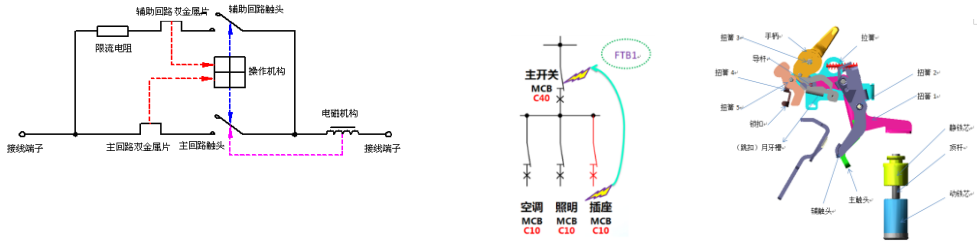

Figure 1 – FTB1 principle schematic diagram and model

3. SIMULATION ANALYSIS

3.1 Motion Analysis

Through discovery curve, the guide rod in motion the process run more smoothly speed, maximum speed of 0.04m / s or so, a large acceleration position appears in the position of the beginning of the movement, because the starting 0 sudden movement, and the other in the trip process, the guide rod back suddenly accelerated from zero, although this time the acceleration is large, may have some impact, but in fact this is necessary, because it is designed by the agency determined the functional requirements, product requirements is a power failure power to quickly process protection circuit. So here it is the large acceleration desired product, but can not be very small acceleration, so power can not achieve rapid effect.

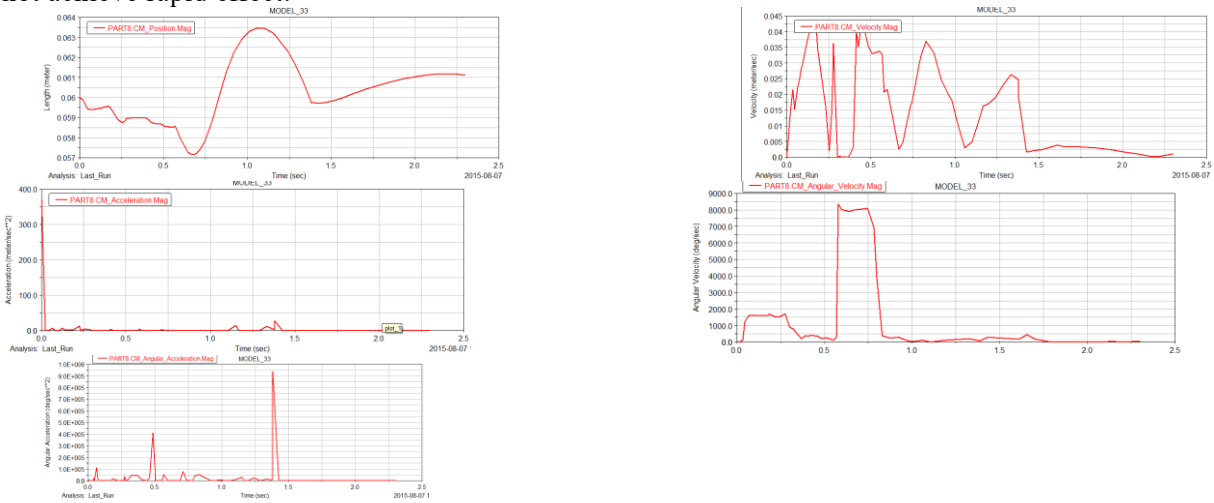

Figure 2 –FTB1 guide rod displacement, velocity, acceleration, angular velocity, angular acceleration curve

3.2 Contact Force

Analysis of the main contact with contact force on a mechanism, through the analysis found that the maximum contact force 0.15N, after the first contact with the whole process of separation, and then contact, which coincide with the actual situation. As shown in Figure 3.

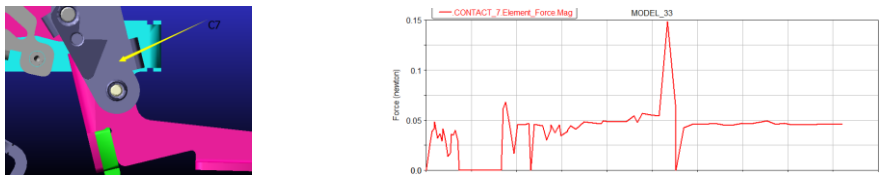

Figure 3 –On a portion of the contact body force diagrams and graphs on contact

3.3 Analysis Of Torsion Torque

From Figure 4, the torsion spring 2 starts holding an initial load (both members move together), then slightly larger (due to the lower half of the member is no longer sport, has touched the stopper) when tripping, suddenly smaller, and finally tends holding steady preload. Consistent with the actual situation. Maximum torque is about 5.1 * 10-5 N.m.

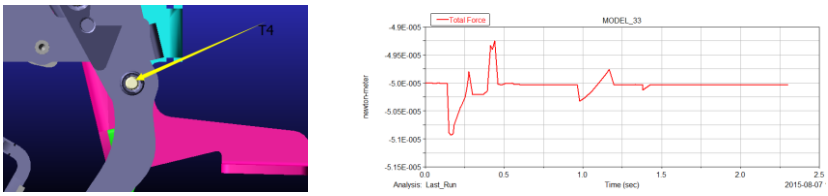

Figure 4 –2 torsion torque schematics and graphs

4. CONCLUSIONS

This article is designed with a choice of circuit breaker protection, and simulation and found bodies in accordance with the original design goals and functional movement and body movement, reliable, stable. A series of components derived motion profile, contact force curve, extension spring torsion force and torque curves, etc., basically consistent with the actual situation. Description The mechanism design is reasonable, can basically meet the functional requirements of the movement, to achieve the purpose of the selective protection circuit, closing, tripping, the reset process is relatively stable and smooth three reasonable. Calculation and simulation results show that the organization is expected to meet the design simulation, simulation results can be found in large parts of the contact force and strengthen its material. Meanwhile, the stiffness coefficients of each of the torsion spring and extension spring are different, the simulation results can guide the selection of the ratio of the tension spring and torsion stiffness coefficients intended to ensure that the movement mechanism of reliable, accurate and stable. Overall, FTB1 product overall organization, and no significant impact, smooth motion, design is more reasonable, sports performance to achieve functional requirements.

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