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The Geneva Mechanism based on SolidWorks modeling and stress analysis

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ABSTRACT:

The outer packaging machines commonly used in the design of Geneva Mechanism for example, was established by Geneva mechanism SolidWorks parametric design Model; use COSMOSXpmss embedded in SolidWorks plug-in, part of the geneva mechanism for stress analysis, to improve the tank engine Structure of the design efficiency.
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INTRODUCTION:

Geneva mechanism with a radial slot by slot wheel and the dial and cylinder pin Composed of a common frame of intermittent motion mechanism, the structure is simple, reliable, Accurately control the angle of rotation [1]. Often requires constant rotation for the indexing machine Movement structure and translocation in the realization of automatic packaging machinery and equipment and a variety of multi-position combination Machine Tool[2-3]. With computer-aided design is widely used in packaging machinery industry Industrial equipment, including mechanical design, including the Geneva mechanism of packaging machinery including Common institutions modeling and optimal design parameters, shorten the product development enterprise week Period, to improve innovation and enhance the competitiveness of enterprises is a key technology. In the regular With institutions to develop parametric design system, the existing literature on the cam, connecting rod machine Institutions such as parametric design studies have been more in-depth [4], motion for Geneva Mechanism Analysis and performance analysis has more depth and comprehensive, and the relevant parameters of the Geneva Mechanism of Design system, especially the use of three-dimensional software for parametric design and analysis of research is still Less in-depth [5-6]. Geneva mechanism other than this example, based on SolidWorks to establish The parameters of the Geneva mechanism model, and using SolidWorks comes with COS- MOSXPress parts of the Geneva mechanism for the stress analysis.

1 geneva mechanism of parametric modeling Geneva

1.1 Kinematical properties and structure parameters

External tank wheel mechanism see figure 1, a slot wheel have z a uniform distribution radial groove, is in the process of time slot wheel turning motion Angle for 2 mouth, active dial the dish corresponding motion Angle for system 2p.. If a

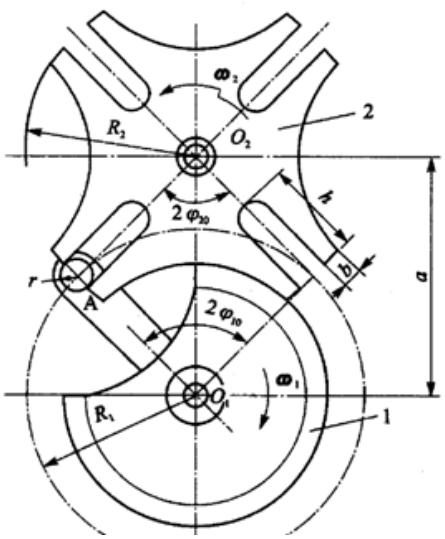

Fig. 1 Geneva wheel mechanism

week of B turn arm turn for t, then between inch may be calculated slot rounds of inversion ta, athletic time slot wheel pause time t; If the known round pin number z ', then every turn will complete z 'times intermittent movement, because active dish is uniform motion, so can beg t and t. In the structural design, first according to the job requirement selected slot number z and dial the number of cylindrical pin disk, z 'centre distance ℒ and circle pins radius, then according to dimensional installation r. size and force size determine other size [6-7].

1.2 The parametric modeling of parts and assembly

The wheel mechanism composed slot for major parts slot wheel and dial the plate etc establish 3d model, taking into account the series and the future to parts of parametric design need revision, must first dimension parameters of parts was parameterized modeling, establishing characteristic model library. Feature means you can use parameter to drive the solid model, is the basic unit, part modeling in the process of modelling of parts graphics complete size constraint geometric constraint and complete definition, also to drive the characteristic dimensions of appropriate variables defined. Each feature geometry shape and size need use variables way to program, said that a visit characteristic variables parameters changed, then this feature size parts as the parameters will be changed, the system will then generation has the required size, the related features of the dimension driven parameters. In the next example trough of various parts of wheel mechanism of parts, modeling process of one size and feature sizes sketch

The variable Settings, convenient in parameterized modeling, modify it only variable size, can get different size parts. According to the design of SolidWorks calculated by the size of the slot wheel mechanism parts established three-dimensional models see figure 3. Among them are shown in figure 3 model is the size of the variationized modify parts size.

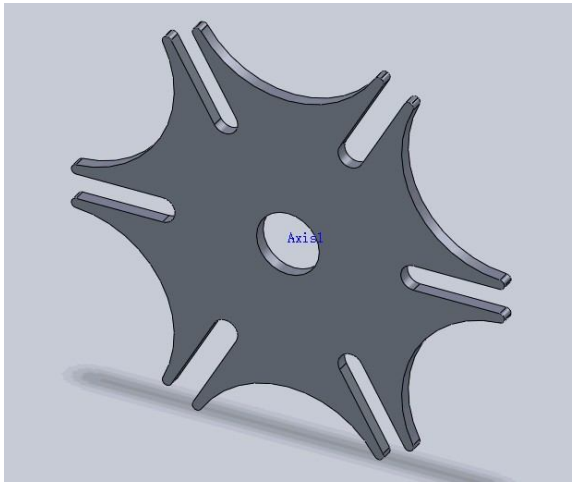

Fig. 2 Parameterized model of Geneva wheel

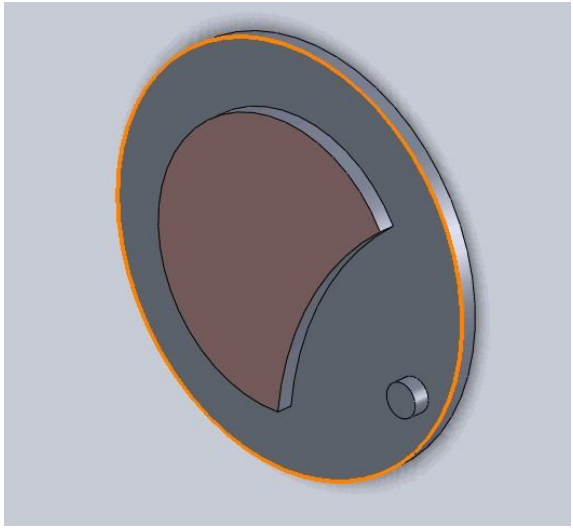

Fig. 3 Parameterized model of moving hand

SolidWorks as one paragraph mainstream 3d design

software, in parametric feature model, surface modeling and mechanical assembly function, particularly prominent application program interface and provide apis (application programming interface), through the various development software carries on the second development, establish interactive interface l8], and through the control and access to the object, SolidWorks on dimension driven automatically generate design specification required for parts of the parts, the parametric design and further second development, design special interface. The wheel mechanism to slot in various parts of was parameterized modeling, high-level programming language for further using VB, VC etc interface design and parameter design, and lays the foundation for the nc machining tool path and G code generated lay a good foundation. Built in Solidworks part modeling analog assembly get assembly model see figure 4, in the process of assembling, need to examine the relationship between parts, and with interference detection of assembly body.

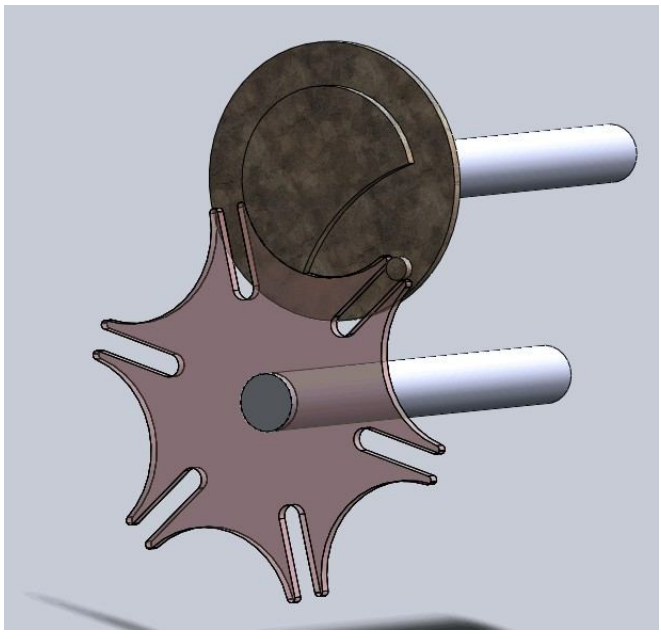

Fig. 4 Assembly model of Geneva wheel mechanism

2 parts stress analysis

In the mechanical part of the design process, on the part of the size and motion characteristics Design calculations, the general to check the strength and stress analysis, often with limited Element method will be decomposed into a number of physical components of the unit elements, then for each Mechanical calculation unit, and finally calculate the overall stress distribution[9]. At home and abroad There are a variety of special finite element analysis software to mesh the part, such as If parts are too complex and will affect the computing speed and accuracy, so the stress points during the Analysis of force before the need to remove from the part. And the part size is not too small, if the super- The software set the minimum size limit, the software will not be solved or there is expression Too long and other issues. COSMOSXpress is provided in the SolidWorks Stress finite element analysis for the part of the efficient tool in three-dimensional design environment Stress distribution directly to the parts inspection to identify design flaws and weak ring Section, to improve the design quality and reliability of parts.

Geneva mechanism in three-dimensional modeling of the various components is complete, you can use SolidWorks plug-ins comes the part the stress sub COSMOSXpress Analysis, this does not require special finite element software, stress analysis of components And optimal design. Geneva mechanism movement, when active pins on the dial to enter from the Groove round, straight pins and sheaves of the tank will be a force. In Figure 2,3 Slot wheel and dial three-dimensional model, for example, adopted in part explain COSMOSXpress excellent Design application. COSMOSXpress is finished using the wizard to guide the way [10]

Into a finite element analysis of the parameter setting mouth to complete the analysis using the COSMOSXpress Requires 5 steps: Define the components of materials, application constraints, application load, of zero Parts, see the results. Stress analysis of their specific process: the Solid-Open COSMOSXpress Wizard Works (1) selection of materials are common Carbon steel "; (2) were selected and dial the central axis of sheave surface is constrained surface; (3) Load Set to force load is applied to the tank cylindrical surface of the side

and straight pins, the direction perpendicular to the subject Force direction, set the load for the 100N; (4) elements of the default size and fine grid Degrees, and conduct operational analysis. After calculation analysis, the lowest part of safety Number (FOS) are 78.2607 and 68.8558, the stress ~ strain shown in Figure 5. COSMOSXpress load the software offers two methods: force and pressure, the load must To be applied to the surface, can not impose on the point or ridge. When the direction of the force as a special party To, the need to pre-establish a base level, then the vertical force and the surface to ensure The direction of the applied loads and the force components in the same direction.

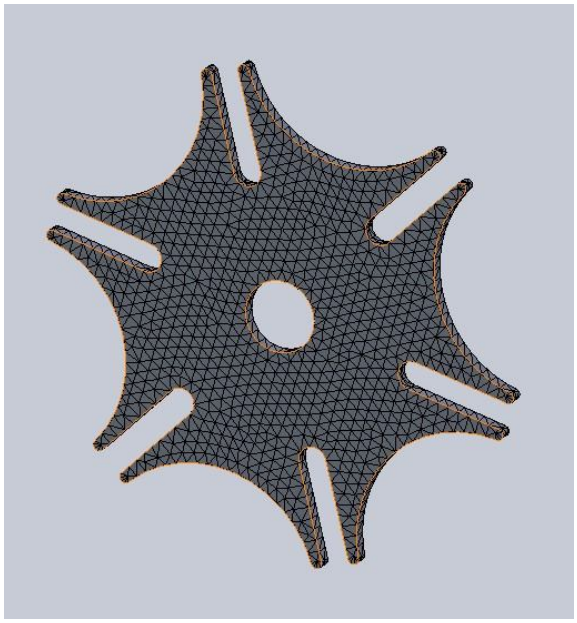

Fig. 5 Stress analysis of Geneva wheel

3 Conclusion

SolidWorks plug-ins using the COSMOSXpress, no other large Special type of finite element software can be commonly used in packaging machinery Geneva Mechanism Component parts for analysis, can be simple, intuitive and effective to simulate the stress components And deformation, the structure of the Geneva mechanism provides a theoretical basis for guiding the design, Jane Calculation of the design process, reducing the pre-design strength, allowing designers to effectively Grasp the part the stress and deformation, saving time and costs.

References:

[1] Zheng Wei, Wu Kejian. Mechanical Theory [M]. Beijing: Higher Education Press, 1996.

[2] Ying Huang is. Structure and design of packaging machinery [M]. Beijing: Chemical Industry Press, 2007.

[3] Yang Liang drainage membered. Outside Geneva charter kinematic analysis [J]. Packaging Engineering, 2004,25 (1): 40 - 41.

[4] Xu Wubin, Yin Huijun cam SOLID EDGE-based three-dimensional design system[J]. Machine Design, 2002,19 (6) :33-35.

[5] Li Baoqian, Tian Hui, Li, Chao, et al. Planter metering device outside the tank round CAD [J]. Agricultural Mechanization Research, 2006, (8) :119-121.

[6] Wang Liangwen, DU Liao, Choi Ji Lei, et al. Automatic mechanical parameters in Geneva Mechanism Design And simulation [J]. Machine Design, 2006,23 (12) :44-46.

[7] Ma Xi. Based on Pro / E's charter Geneva Mechanism Modeling and Simulation 『J]. Packers Cheng, 2008,29 (2): 36 - 37.

[8] Jiang Hong, Li Zhongxing, Xingqi En. SolidWorks 2003 and examples of secondary education development foundation Process [M]. Beijing: Electronic Industry Press, 2003.

[9] Cao Xijing, Cheng Wei Chao, Guo Yanwei. Accurate modeling of gear based on SolidWorks and should be Force analysis [J]. Mechanical transmission, 2007,31 (5): 65 ~ 66.

[10] Dong Hongtao, Li Yongkui, Gesheng Fu, et al. Mechanical parts based on static COSMOSXpress State of stress analysis [J]. Shenyang Agricultural University, 2006,37 (1) :117-118.

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