

# Design and Research of Ginkgo Leaves Retractable Picker

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**Abstract:** Ginkgo biloba is an ancient plant, widely distributed in China. Ginkgo biloba leaves have very high medicinal value, and play a positive role in the treatment of many diseases. In order to solve the problem of ginkgo leaves picking, a retractable ginkgo leaves picking machine was designed according to its plane mechanism principle. In single-person operation, the plucker exerts force on the push rod and transfers the force to the plucker through the telescopic rod. The two pluckers cooperate with each other. The ginkgo leaves are picked by opening and closing state, and the ginkgo leaves are collected by the leaf storage device. The utility model has the advantages of simple structure and convenient operation, reduces the labor intensity of the picking workers to a certain extent, and reduces the danger of the picking workers.

**Keywords:** Telescopic Rod, Support Rod, Picker, Leaf Storing Device

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## 1. Introduction

Ginkgo biloba, also known as the white fruit tree, belongs to gymnosperm. Ginkgo biloba leaves are the dried leaves of Ginkgo biloba, which have high medicinal value [1-6]. The development and utilization of Ginkgo biloba leaves began in the 1930s. Studies have found that Ginkgo biloba leaves have higher nutritional components, including protein, sugar and vitamins. The protein in Ginkgo biloba leaves can be comparable to that in soybeans. It is a good food additive [7]. The chemical composition of Ginkgo biloba leaves was first studied. Scholars are Chinese and Western Fragrances, from which they isolated a variety of flavonoids in the 1920s [8].

Ginkgo biloba leaves can improve cerebral ischemia and central nervous system, prevent ischemia, hypoxia and brain edema, promote the recovery of brain cell function, and reduce the area of thrombotic cerebral ischemia. At the same time, the extract of Ginkgo biloba leaves can prevent and treat Alzheimer's disease. In order to obtain more useful ingredients from Ginkgo biloba leaves, scientists at home and abroad continue to explore the extraction technology of Ginkgo biloba leaves. With the improvement of science and technology, the substances contained in Ginkgo biloba leaves will be constantly found.

Scientific picking of Ginkgo biloba leaves plays an important role in maintaining the quality of Ginkgo biloba leaves. Ginkgo flavonoids are good drugs for treating

cardiovascular and cerebrovascular diseases. Ginkgo biloba leaves is the main way to obtain ginkgo flavonoids. October of every year is the season with the highest content of ginkgo leaves flavonoids, so we should concentrate on picking Ginkgo biloba leaves in this time [9-10].

As a result of the growth environment of Ginkgo biloba leaves, so far, the extraction of Ginkgo biloba leaves is mainly artificial. Artificial picking is inefficient, and the picking time of Ginkgo biloba leaves is mainly concentrated in July, August and September. Artificial picking cannot guarantee timely picking of Ginkgo biloba leaves.

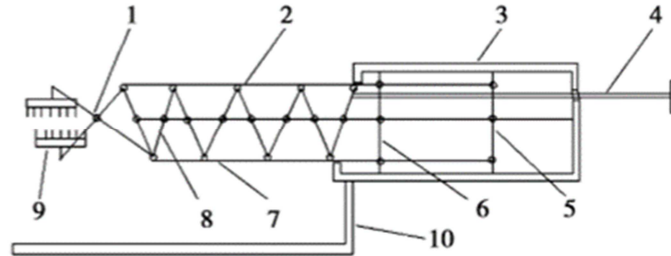
Ginkgo biloba leaves have high medicinal value, but for a long time there has been a lack of effective picking machinery. In most areas of China, bamboo pole beating is still used for picking. This method is not only inefficient, but also prone to picking accidents, and the damage to mother trees is also very great [11]. Although the existing patented products have improved the picking efficiency of Ginkgo biloba leaves to a certain extent, there is a lack of collecting devices, and the extracted Ginkgo biloba leaves still need to be collected manually [12-15]. In order to solve the problem of ginkgo leaf picking, improve the picking rate and reduce labor intensity, this kind of retractable ginkgo leaves picker was designed.

## 2. The Working Principle of Picker

The structure of the retractable ginkgo leaves picker is

shown in Figure 1. It utilizes the principle of plane connecting rod mechanism. The support rod in the retractable barrel is controlled by a push rod to fold and move, and the retractable ginkgo leaves is picked by controlling the opening and closing of the retractable ginkgo leaves picker. There is no need to pull and pull artificially during picking. Pickers only need to control picking barrel

and push rod by one hand. Ginkgo leaves and branches can be separated by folding of supporting rod and opening of picking device. After separation, the leaves of Ginkgo fall into the leafholder by gravity. When the leafholder is full, the leaves of Ginkgo can be sent to the collection place, and then the leaves of Ginkgo can be sent to the collection place. Continue picking.



1. Movable connection points; 2, 7. Telescopic rods; 3. Picking barrel; 4. Push rod; 5, 6. Fixed support rod; 8. Support rod; 9. Picker; 10. Leaf storage device

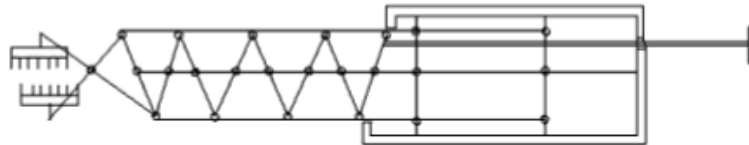
**Figure 1.** Structure of Ginkgo Biloba Leaf Picker.

### 3. Design of Each Part of Picker

#### 3.1. Design of Picking Part

The structure of the picking part of the picking device is shown in Figure 2. It is mainly composed of push rod, picking barrel, expansion rod, support rod and picking

device. The fixed support rod and picking barrel in the picking barrel are fixed connections. Its main function is to support the expansion rod, and at the same time to limit the range of movement of the expansion rod in the picking barrel. A movable connection is adopted between the push rod and the picking barrel. The push rod can push and pull around the connection point in the picking barrel.



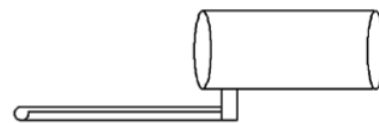
**Figure 2.** Structure of picking section.

When the push rod is pulled outward, the support rod extends under the action of the connecting rod. At this time, the distance between the expansion rod becomes smaller, and the expansion rod is made on the fixed support rod. Downward movement, the telescopic rod elongates under the drive of the support rod, and the harvester begins to close, slowly fastening the branches of Ginkgo leaves. Push the push rod forward, fold the support rod, and separate the leaves and branches of Ginkgo leaves. In this process, with the increase of the leaves of Ginkgo leaves at the picker, the picker gradually opens under the drive of the support rod to ensure the integrity of the picked leaves of Ginkgo.

#### 3.2. Leaf Storage Part Design

The connection between the leaves storage device and the picking barrel is shown in Figure 3. The leaf storage device is located below the picking barrel and is fixed between the two. The leaves storage device is semi-circular and concentric with the picking barrel. There is no shield at one end of the leaf storage device, which facilitates the pouring out of Ginkgo leaves. Leaf accumulator not only collects Ginkgo leaves, but also plays a guiding role for the picking of Ginkgo leaves. When picking, because the telescopic rod

is folded, the left end of the leaves storage tube can be aligned with the ginkgo leaves to be picked, and then the plucker can be controlled by a push rod.

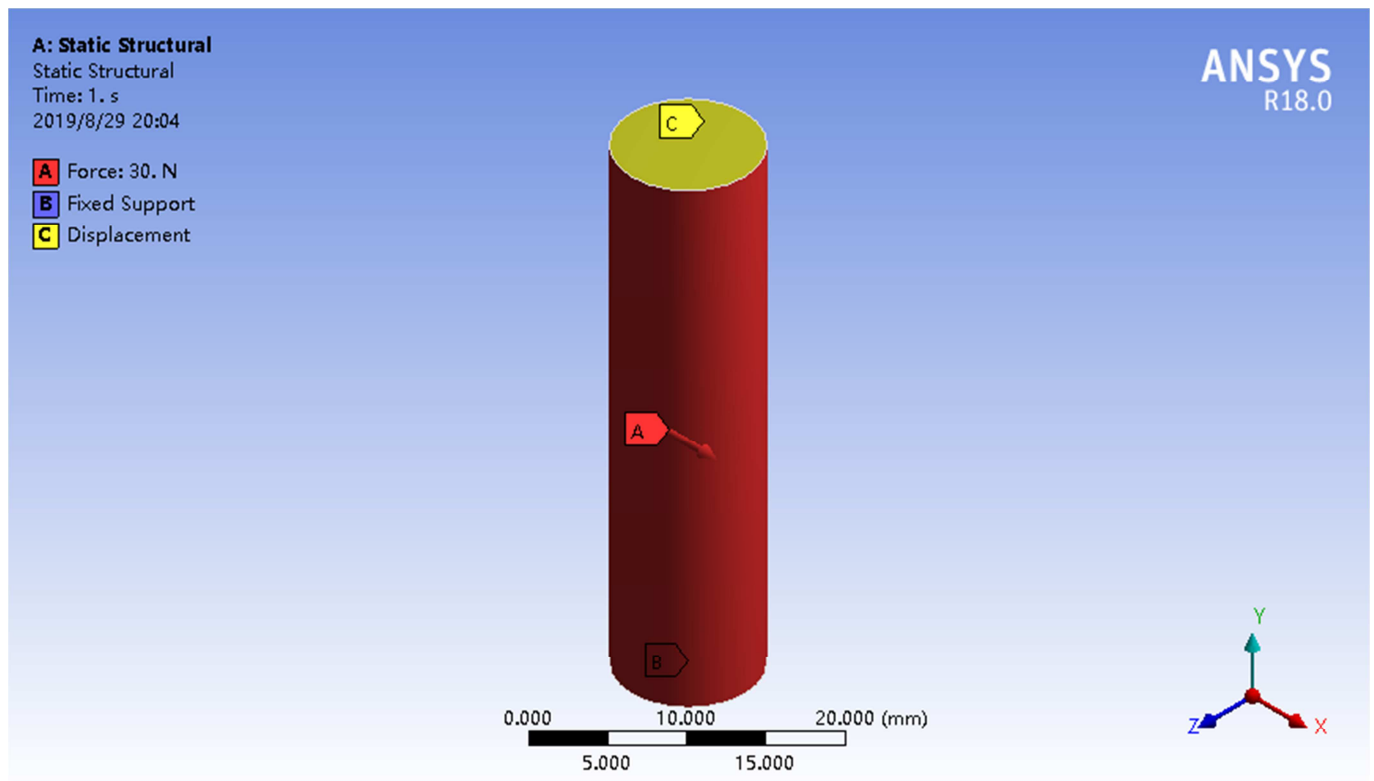


**Figure 3.** Connection schematic diagram of picking cylinder and leafholder.

#### 3.3. Finite Element Analysis

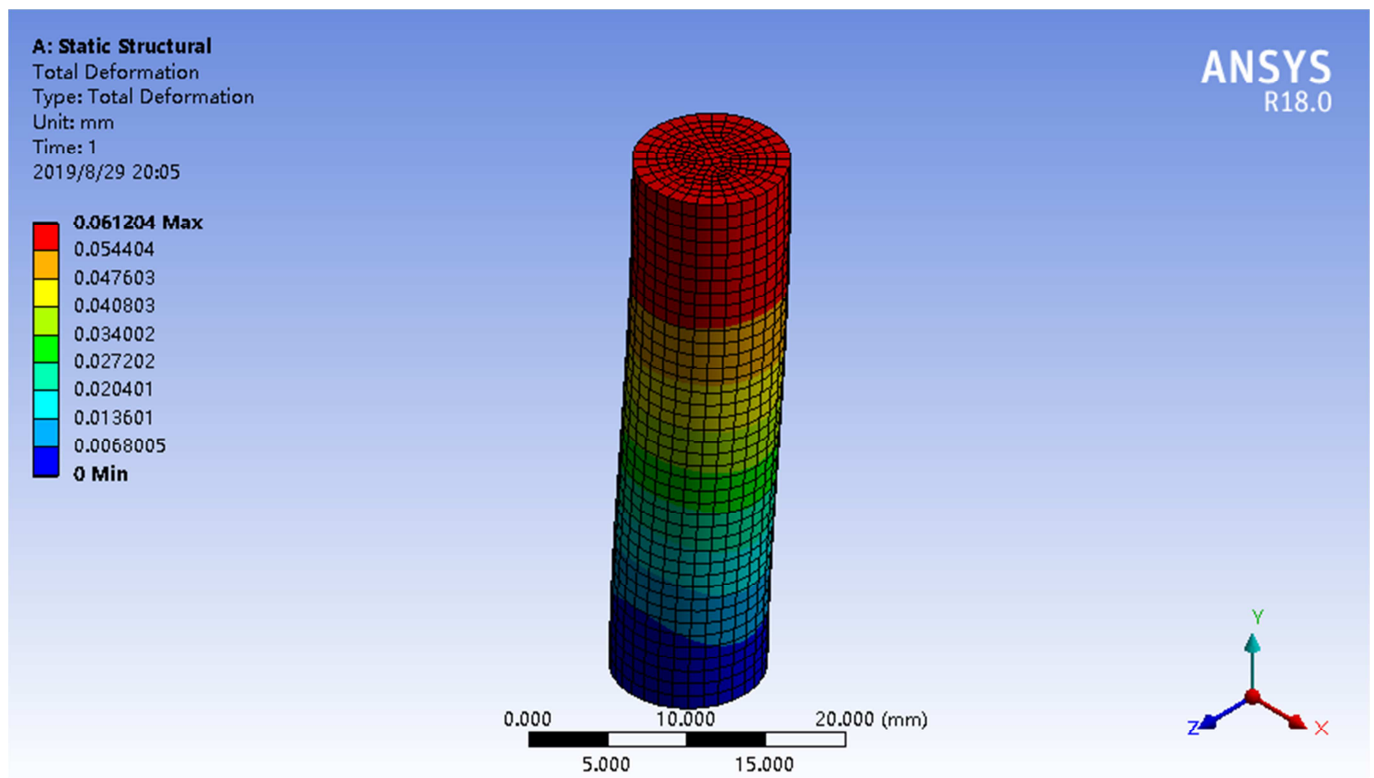
In the process of picking, both ends and middle parts of the support rod are in the state of force and activity. The force analysis of the support rod is more complex. This analysis uses ANSYS software, first of all, the support rod is meshed, and the material selection of the support rod. For polyvinyl chloride, the support rod is a slender cylinder with a length of 400 mm and a radius of 10 mm.

The middle of the support rod is point A, as shown in Figure 4. Point A is the stress point, the force is 30N, the two ends are point B and point C, point C is the movable point, point B is the fixed point.



*Figure 4. Static Structure Diagram.*

Applying 30N to the support rod, the total deformation of the support rod is analyzed by ANSYS software, as shown in Figure 5. At the same time, the equivalent force, maximum principal stress and shear stress of the support rod are analyzed, as shown in Figure 6, Figure 7 and Figure 8.



*Figure 5. Total Deformation Map.*

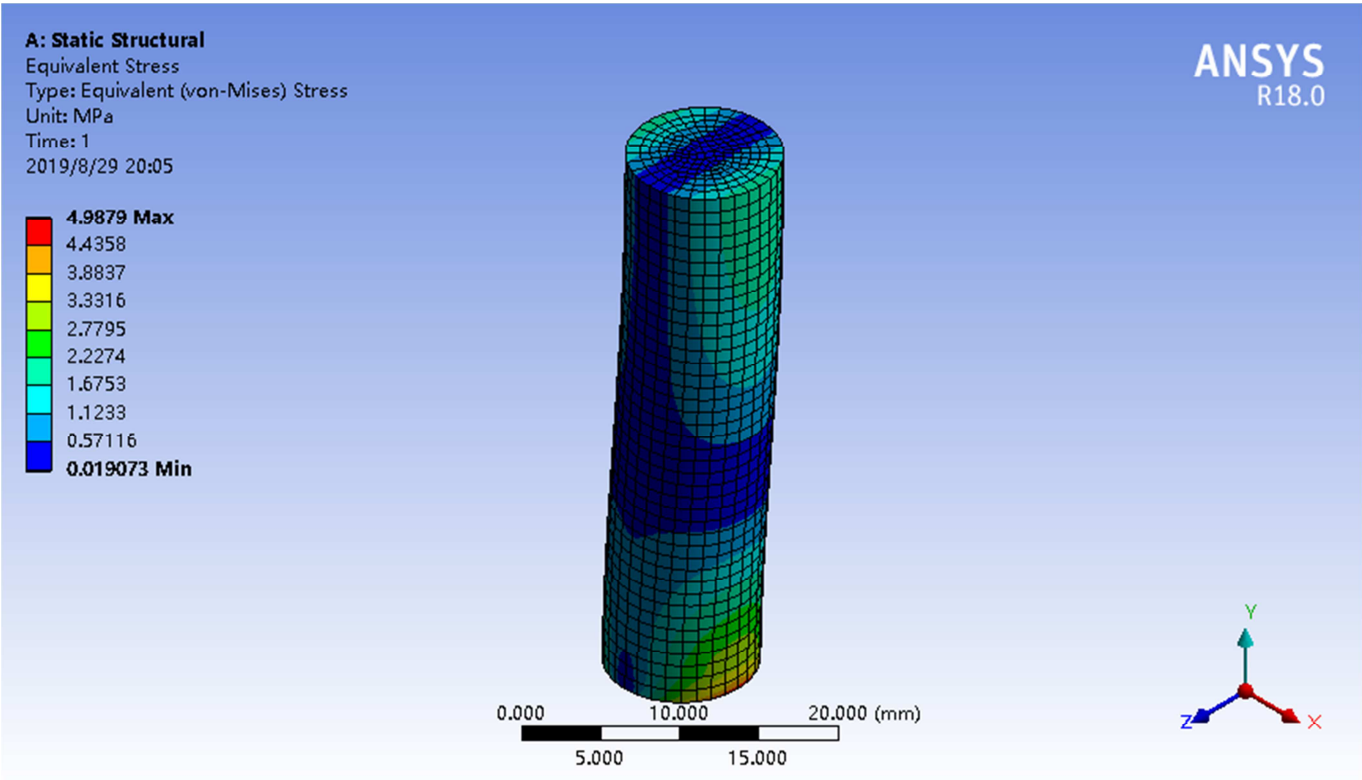


Figure 6. Equivalent Stress Analysis Diagram.

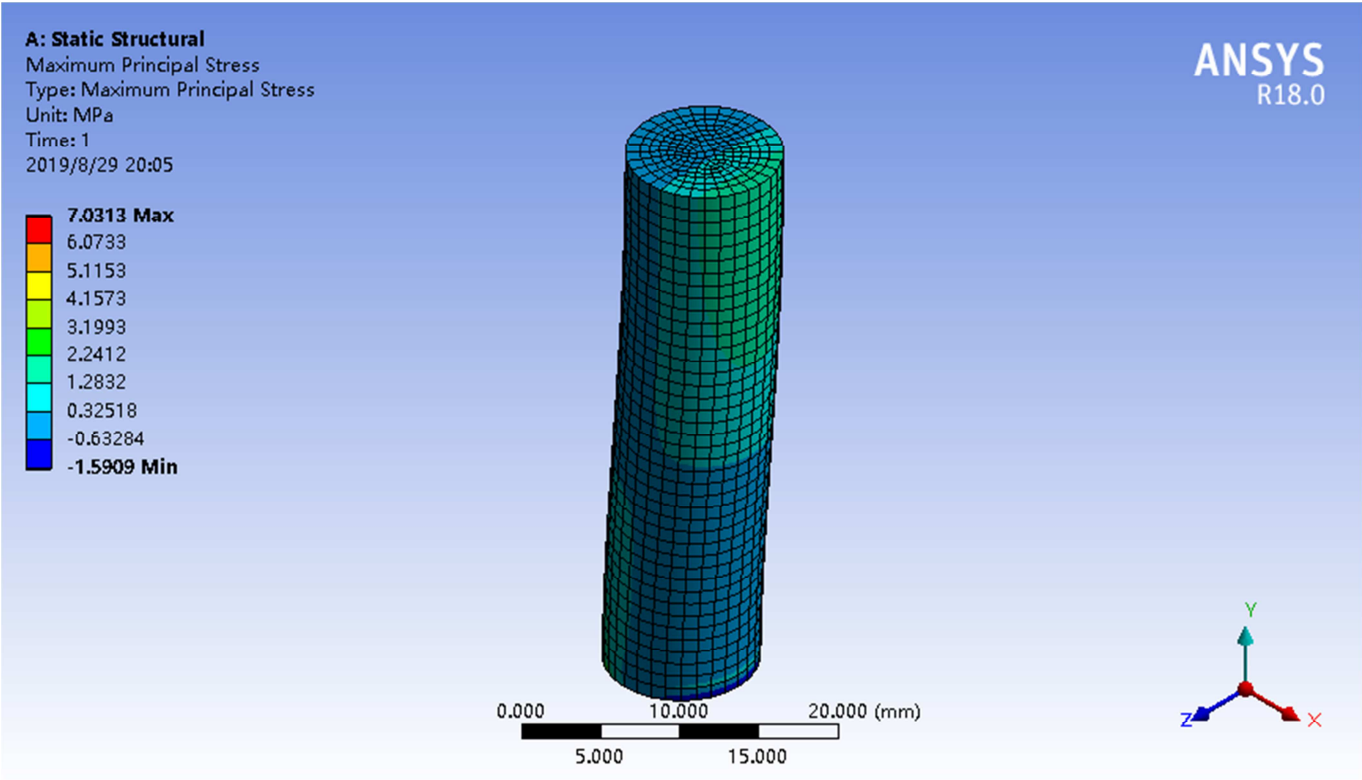


Figure 7. Maximum Principal Stress Analysis Diagram.

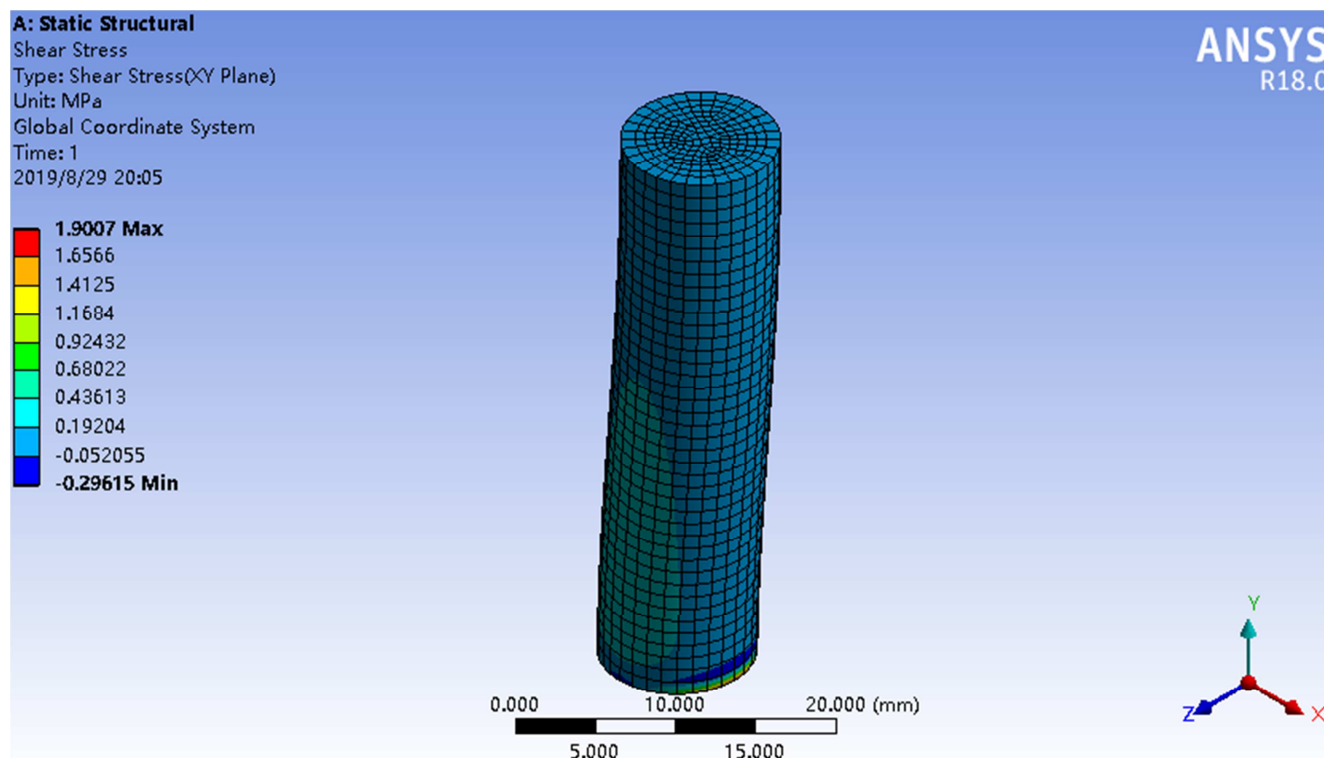


Figure 8. Shear Stress Analysis Diagram.

According to the analysis diagrams of equivalent stress, maximum principal stress and shear stress, and total deformation diagrams, it is concluded that under the action of external force, the supporting rod does not fail, and can work normally, which meets the design requirements.

#### 4. Summary

The retractable ginkgo leaves picking machine designed in this paper belongs to a semi-automatic and convenient picking mechanism. The main power source is provided by the picking workers. Its advantage is to protect the fingers of the picking workers and increase the picking scope of the picking workers.

When picking, the picking workers keep a certain distance from the branches of Ginkgo biloba leaves. One hand holds the picker, one hand controls the push rod, and picks the leaves of Ginkgo biloba. This avoids the phenomenon that the branches of Ginkgo biloba leaves grab the branches of Ginkgo biloba leaves with one hand and the branches of Ginkgo biloba leaves grab the workers with the other hand.

The retractable ginkgo leaves picker combines picking and collecting into a working process, and uses the principle of planar linkage mechanism to pick, which reduces the labor intensity of operators to a certain extent. The design is simple in operation, simple in structure and low in cost, and has broad application prospects.

#### References

- [1] Wang Yusheng, Deng Wenlong, Xue Chunsheng. Pharmacology and Application of Traditional Chinese Medicine [M]. 2 Edition. Beijing: People's Health Publishing House, 2000.
- [2] Wang Chao, Wang Hong. Clinical application of Ginkgo biloba extract [J]. Chinese Medical Guidelines, 2012, 10 (11): 86-87.
- [3] Jin B. Cytological, physiological, and transcriptomic analyses of golden leaf coloration in Ginkgo bilobaL [J]. *Horticulture Research*, 2018, 5 (1).
- [4] Gevrek F. Histopathological, immunohistochemical, and stereological analysis of the effect of Ginkgo biloba (Egb761) on the hippocampus of rats exposed to long-term cellphone radiation.[J]. *Histology & Histopathology*, 2017: 11943.
- [5] Ren X J, Yang Z B, Ding X, *et al.* Effects of Ginkgo biloba leaves (Ginkgo biloba) and Ginkgo biloba extract on nutrient and energy utilization of broilers [J]. *Poultry Science*, 2018.
- [6] Fu W, He X, Xu S, *et al.* Changes in nutrients and decay rate of Ginkgo biloba leaf litter exposed to elevated O<sub>3</sub> concentration in urban area.[J]. *Peerj*, 2018, 6 (3): e4453.
- [7] He Jian. Research Progress of Ginkgo biloba leaves [J]. *Chinese Pharmacy*, 2011, 22 (15): 1434-1436.
- [8] Wang Feijuan. Research Progress of Flavonoids in Ginkgo biloba Leaves [J]. *Northwest Journal of Pharmacy*, 2010 (2): 155-156.
- [9] Sun Hong, Xuemei, Ginkgo biloba leaf scientific picking methods [J]. *Science and technology enrichment guide*, 1997 (9): 43-44.

- [10] Du Gaofeng. Matters needing attention in Ginkgo leaf picking [J]. Southwest Horticulture, 1999, 27 (4): 53-54.
- [11] Yao Jianlin. Ginkgo Leaf Harvesting and Ginkgo Tree Protection [J]. Anhui Forestry, 1997 (2): 17-17.
- [12] Tang Benxing. Ginkgo biloba leaf picker: China, CN201220606750. X [P]. 2013-05-15.
- [13] Guo Zhiyue, Wang Wei, Zhuangyu, etc. Design of Agricultural Information Acquisition System Based on SolidWorks [J]. Forest Engineering, 2015, 31 (4): 92-97.
- [14] Leiqian, Yang Yongfa. Design of Portable Variable Diameter Spherical Rosa roxburghii Harvester [J]. Forestry Machinery and Woodworking Equipment, 2017, 47 (3): 26-28.
- [15] Yang Dengjie, Zhang Cunmeng, Zhu Daigen, et al. Design of retractable ginkgo leaf picker [J]. Forestry machinery and woodworking equipment, 2017, 45 (7): 30-31.