

# APPLICATION OF VIRTUAL MANUFACTURING IN FIELDS CULTIVATE MACHINES

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**Abstract:** The paper introduces virtual manufacturing application in the Fields Cultivate Machines and mainly discusses the model-building of rotary-cultivate part, physical model and mathematical model included. With the model, the rotary knife is optimized, the force on the bend part is decreased, and therefore, the service life is prolonged. At the same time, with dynamic analysis software Adams, the moment curve of the rotary knife is simulated, which provides a basis for the improvement of stability and farther research in future.

**Keywords:** Virtual Manufacturing, Dynamic analysis, Fields cultivate machine Rotary knife, Mathematical model, Physical model

## 1. INTRODUCTION

Virtual Manufacturing is a synthesized development and application of computer-simulation technology and virtual-reality technology. With VM, the actual manufacture can be realized essentially on computer. It is, based on information integrations, a new manufacture philosophy of enterprises. The extensive application of the virtual manufacturing technology will change the present manufacture pattern thoroughly, and will bring various kinds of changes into enterprise organization, business management and production methods and so on. It also will have the huge influence to the

correlation profession, and will be one of important content of next generation manufacture technology. It is said surely, Virtual Manufacture technology will decide enterprise's future, and also will decide whether or not manufacturing industry can play an important role in the competition.

Pro/Engineer is a large-scale design software which integrates with CAD/CAM/CAE. The modules in common used by CAE are Mechanism Design Extension and Pro/MECHANICA. Comparing with high specialized analysis software, Pro/E is not a worthy opponent, however, up to now, Pro/E is still used most widely in all three-dimension software. Its accuracy rate of analysis reaches to 99%, and it is quite convenient and is popular to major users.

The fields cultivate machine has already applied commonly and mainly in some big awnings today. Although it has many functions, its work is not stable sometime, main reason is that various kinds of functions have not been considered completely in primary design. For having a more stable work, the construction and simulation must be done with some large-scale software. Nowadays, the higher quality cultivate machines are needed. Therefore, cultivating machines simulation is necessary so that model optimization can be realized, and intensive cultivation can be achieved.

## 2. MODEL ESTABLISHMENT

At first, with Pro/Engineer, the rotary-cultivate part of the machine should be built, for example in Fig.1.

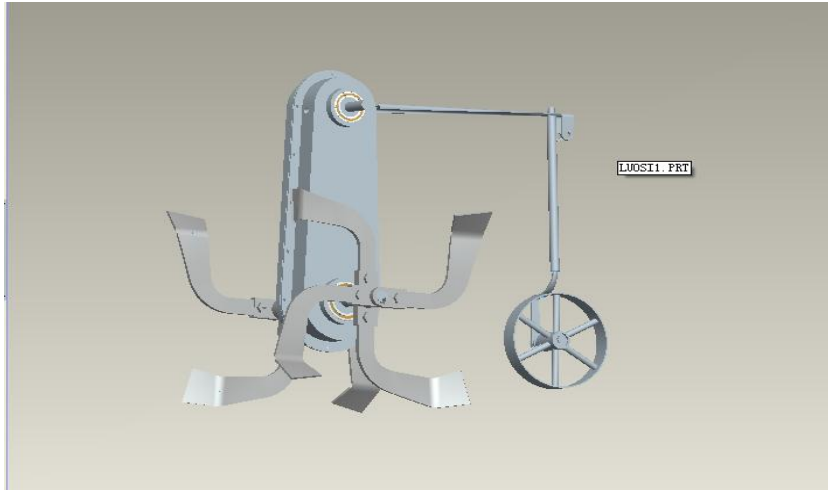


Fig.1 General Structure of model

The parameter method is adopted in the model establishment completely, the model can be revised easily, so that continued optimization can be realized conveniently, until the request is fulfilled.

The analysis result of a mechanical system, from initial geometry modeling to dynamics modeling, is obtained in the end, through the numerical value solution of the model, the analytical results can be obtained finally, and the whole process can be expressed in Fig.2.

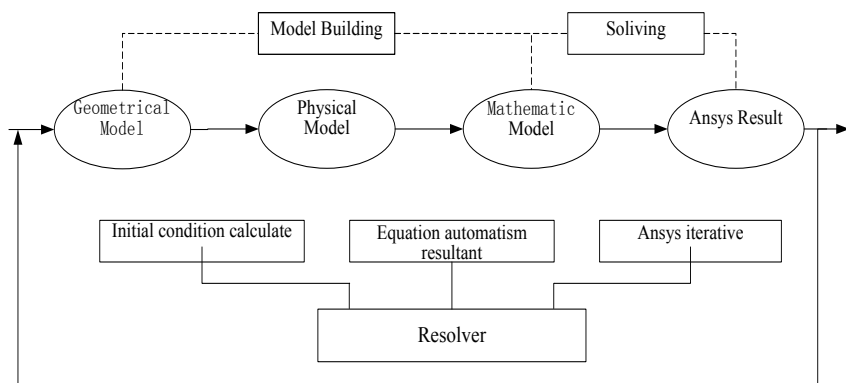


Fig.2 the general course of calculate many systematic dynamics modeling and solution

The whole process of polypore system of dynamic analysis includes two stages : constructing and solving models. Constructing model divides into both physical modeling and mathematical modeling, physical modeling is the model which can be established by geometry modeling; Mathematics modeling is another model which can be constructed by physical model. The geometry modeling is formed of geometry-constructing modeling of analysis system of dynamics , or is introduced through general geometry-modeling software. Putting the kinematical restraint, the driving restraint, the force unit, external force or external moment into geometry model, the physical model may be formed, which is able to describe mechanics trait of the system. In process of physical modeling, Sometime the geometry model needs to be assembled in the light of the kinematics restraint and the initial position condition. With the physical model, Cartesian coordinates or the Lagrangian coordinates constructing-model method, and the application of automatically constructing-mold technology, various kinds of coefficient matrix can be built and the mathematical model of the system can be obtained. Using analytical and calculation methods of kinematics, dynamics, static equilibrium or restores dynamics. Analysis results needed are obtained with iterative solution . Combining with design goal, the result is analyzed repeatedly, which is returned the process of physical and geometry model, so that best result of the design is acquired.

### 3. OPTIMIZATION MODELS

It is necessary to optimize rotary knife for the sake of durative use, the process is shown on the following fig.3:

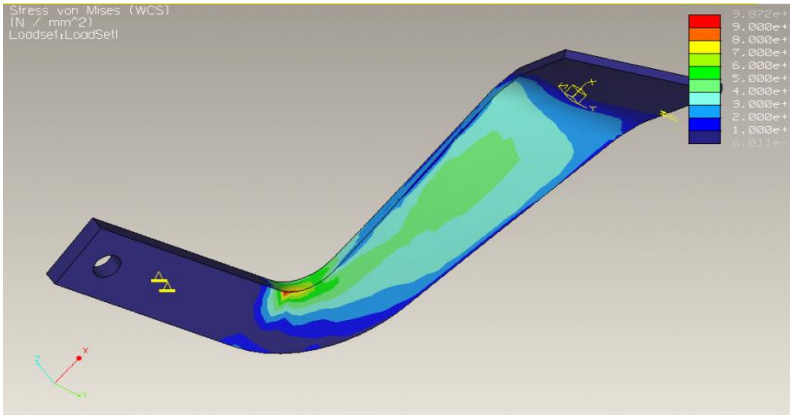


Fig.3 Force analysis of Rotary Knife

From Fig.3 , it is known that great force (about 9.072N/mm<sup>2</sup>) is put on the bent part of rotary knife. After optimization, although the force which applies on whole knife is equal, the force on the bent part becomes weak. The optimized knife is shown in following Fig.4. The force put on bent part of the knife which is optimized is about 8.313N/mm<sup>2</sup> so that the knife is durable.

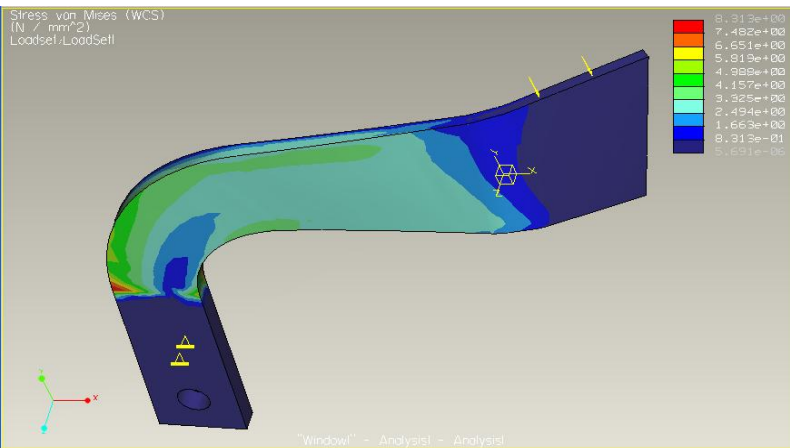


Fig.4 The rotary knife which received strength after optimizing

### 4. MODEL DYNAMICS ANALYSIS

After optimization, effective dynamics analysis can be adopted with Adams software. During work process, the movement curve of rotary knife is shown below fig.5. Through dynamics simulation of rotary knife by Adams, the speed ,acceleration , angular velocity and the force moment of rotary knife in the course of working are measured. Its certain shortage can be improved.

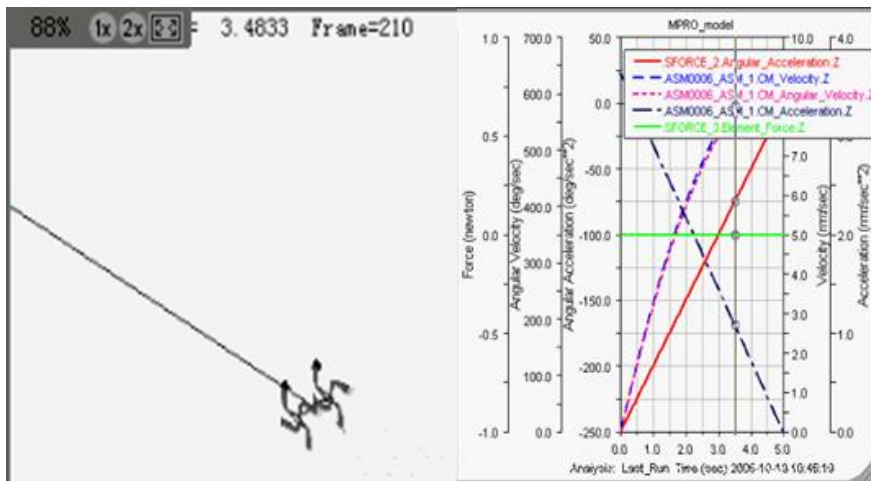


Fig.5 The movement trajectory of Rotary

### 5. CONCLUSION

Through using virtual manufacturing technology in fields cultivate machine, every components of the machine have been optimized, without question, feasibility of virtual manufacturing technology have been proved.

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