MODELLING AND ANALYSIS OF INLINE DRIPPER IN IRRIGATION

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ABSTRACT:
Agriculture is backbone of our country. Nearly sixty percent of people in our country depend on irrigation. But farmers of many parts of the world are not aware of advancements in agriculture. There is no awareness among farmers which lead to the situation that farmer have stopped growing crops due to no profits. There are many improved methods in irrigation; one of such methods is drip irrigation.. Each plantation requires different types of drippers. The present available size of dripper is of weight 1.9gm for discharge of 4 l/h. In this project it is aimed to reduce weight of dripper to 1gm .PRO-E and ANSYS software's are used for static structural analysis of dripper. Results after modification of design to 1 gm the total deformation 0.00021165 mm and equivalent stress in 3.9764 (MPA) it increases productivity and initial cost of the dripper gets reduced.

Keywords*: Dripper, Discharge of 4lph, Size of dripper, software's: Pro-E, ANSYS work bench*

I. INTRODUCTION

India is golden land for agriculture. It is backbone of our country. Irrigation without India is impossible. It is the main source of income to most of the people in India. India is developing fast in various recent innovations in irrigation. Rain water is main source for fetching water to crops in India. This rain water is supplied through rivers, wells, ponds and many other sources. But it is very pity thing that most of the places in India suffer from scarcity of water. India is blessed with plenty of resources but due to lack of proper awareness farmers are not growing crops up to the mark. India is very backward when compared to other countries. Most of the farmers in India are not aware of irrigation methods in India. Different types of crops need different amount of water as per requirement for example mango, banana etc require water eight liters per hour, tomato and potato require 4 liters per hour. This method is used in farms and gardens also. Drip irrigation is a practice since years ago. In olden days people Used pots for fetching water to crops with small holes at their bottom. These pots are placed exactly near the place where plant roots are growing. This is such that the roots get sufficient water which helps plants to grow effectively. [1]

Fig 1: Photographic View of Drip Irrigation

This method originally brought from china in 15 century. This later on went to usage of plastic tubes. This was first invented by Hannis till an Australian Scientist. This drip irrigation can also be called as micro or trickle irrigation. Drip irrigation is a time taking process. This plays a key role in cities where municipalities restrict water supply for both residential and commercial purposes. This method is mainly used in summer and winter seasons where farmers face more shortage of water. This method is beneficial to the people in areas of desert regions

Working of Drip Irrigation system

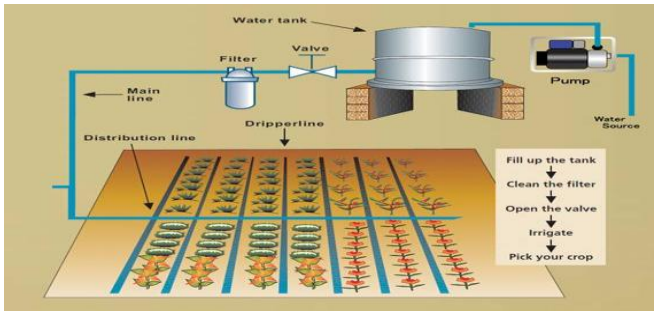

Fig 2: Working Process of Drip Irrigation

Water is supplied through to plantation through water resources like well, ponds, nearby lakes and rivers. Through an electric pump water is extracted from water resource. Water is primarily supplied to a water tank. This water is released out to a filter through valve. Water can released whenever it is necessary by opening the valve.

After the filtration process is completed the water is supplied to main line. This main line is connected to certain number of distribution lines. These distribution lines depend upon type plantation and area of plantation. There are some drippers placed at some distance inside or outside of distribution lines depends upon crop to be yield. Water flowing through the distribution pipes gets obstructed by drippers where flow rate of water gets reduced.[3]

II. DESIGN CALCULATIONS OF SHORT DRIPPER

Long dripper has been in market since years ago. Short dripper is recent advancement of long dripper. Long dripper has been reduced to short dripper by reducing its weight from 1.9 g to 1 g. Then automatically design of short dripper gets reduced that is the L shaped curves where the flow of water gets obstructed and output of water is as per the long dripper only that is 4 LPH. The main is to reduce cost. [3]

Design Calculations

Long Dripper:

Height = 240 mm

Radius = 8 mm

Area of cylinder = $2\pi rh+2\pi r^2$ …..(1)

= (2 x π x 8 x 240) + (2 x π x 8^2)

=12057.6+401.92

=12459.53 mm^2

Short Dripper:

Height = 160 mm

Radius = 8 mm

Area of cylinder = $2\pi rh+2\pi r^2$ ……(2)

= (2 x π x 8 x 160) + (2 x π x 8^2)

= 8038.4+401.92

= 8440.32 mm^2

Discharge Q = A x V…… (3)

Here both discharge Q and velocity V are constant.

So both the discharges of long dripper and short drippers are compared, here only area differs.

Number of L shaped curves for long dripper = 65

As area is the only parameter that is going to change, then

For long dripper of area 12459.52 mm^2 = 65 number of L shaped curves

For short dripper of area 8440.32 mm^2 = y

Where y is unknown = number of L shaped curves for short dripper

Then 12459.52 x y= 65 X 8440.3

y = 65 X 8440.32 / 12459.52 = 44

So number of L shaped curves for short drippers are 44.

III. INTRODUCTION TO PRO-E

PRO-E mechanical design solution will improve our design productivity. PRO-E is a suit of programs that are used in design, analysis and manufacturing of a virtually unlimited range of the product.

"Solid modeling" means that the computer model we create is able to contain all the information that a real solid object would have. It has volumes and therefore, if you provide a value for the density of the material it has mass and inertia [5]

Modules in PRO-E

Following are the important module of PRO-E:
1. Sketch Module
2. Part module
3. Geometric modeling

Modeling Procedure:

Open creo 2.0 software. As you open the cero 2.0 a definition box will appear which represents the following modules.

1. Sketcher
2. Part
3. Sheet metal
4. Assembly
5. Drawing(drafting)

Now select the part module and deselect the default templates and select the required measurements in mmns or inlbs mostly mmns is preferred.

***1. Revolve*:** To Add or remove material in counter clockwise direction.

Procedure: Revolve -- Placement – Select the sketch plane – Create the center line –Draw the required sketch—Mention the angle -- Preview – Ok

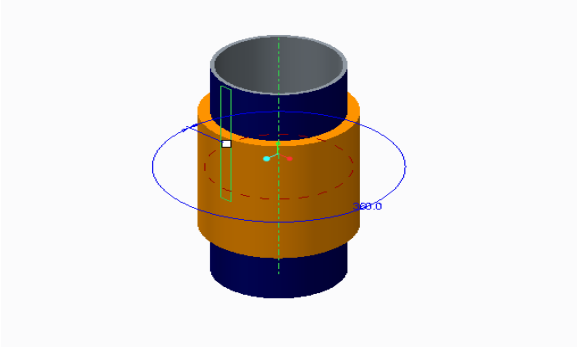

Fig: 1.1-Revolve operation

2. Mirror:

To create the duplicate object with reference to datum plane or flat surface

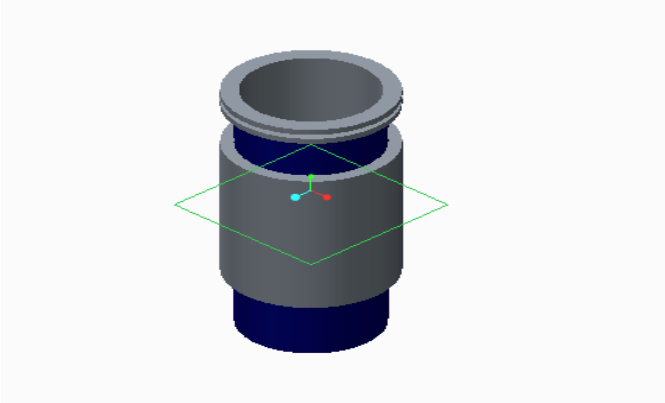

Fig: 1.2-Mirroring operation

Procedure: Select the object – Select mirror tool which is highlighted – Select the reference plane or surface -- Preview -- Ok.

***3. Project*:** The project parameter is used to reflect the sketch on to the plane which we want to project. This reduces the design risk such that once if we draw sketches then exit sketcher and select plane for projection.

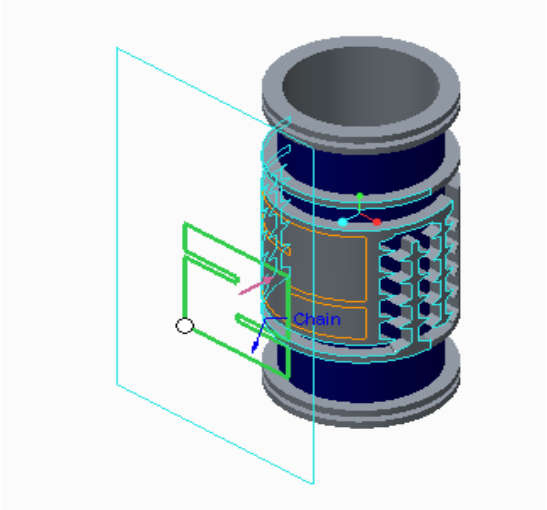

Fig: 1.3-Projection on to a plane

***4. Extrude*:** To add or remove material in orthogonal direction.
Procedure: Extrude -- Placement – Selection of sketch plane – Draw the sketch – Mention the depth -- Preview – Ok.

***5. Remove*:** The name itself indicates that removal of material. This is used to remove material wherever it is necessary.

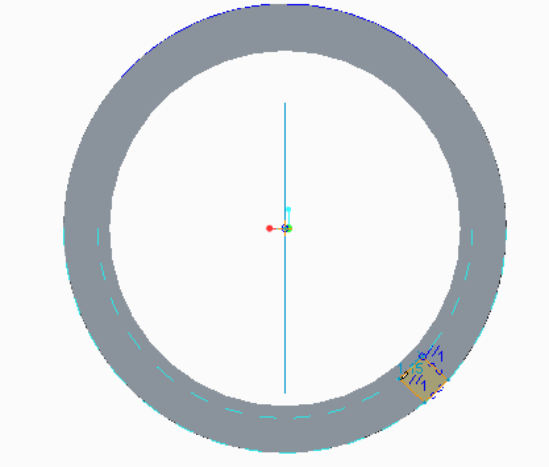

Fig: 1.5-Removal of Material

The following represents the final component.

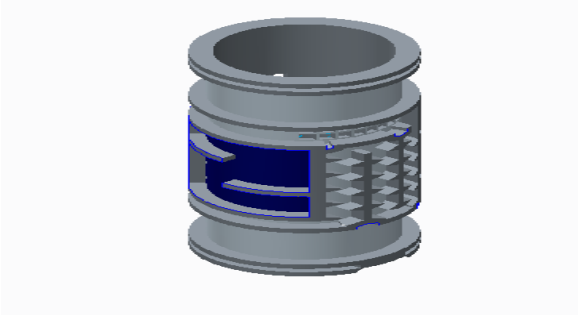

Fig: 1.6 - Final component

IV. INTRODUCTION TO ANSYS

ANSYS is engineering simulation software it was developed in Pittsburgh Pennsylvania, United States. ANSYS was listed on the NASDAQ stock exchange in 1996. In late 2011, ANSYS received the highest possible score on its Smart Select Composite Ratings according to Investor's Business Daily. In this project static structural analysis is done. This of two types one is before modification and another is after modification. [6]

1. Static Structural Analysis: (before modification)

Double click on the Static Structural it opens Ansys Mechanical Window. This window contains many tools to do the analysis. In order to find total deformation and equivalent stress we have to first apply mesh, fix the model next and apply pressure. Then solution first one total deformation is 0.00032473 mm, which is very low as compared to the body size and stress obtained is 5.6301 MPA.

2. Static Structural Analysis: (after modification)

The process is same for short dripper also that is after modification. Hence the solution is as follows. The total deformation is 0.00021165 mm, which is very low as compared to the body size. The stress obtained is 3.9764 MPA

V. RESULTS AND CONCLUSIONS

Table1: Stress and Total Deformation

Model	Equivalent Stress in MPA	Total Deformation in mm
Before Modification	5.6301	0.00032473
After Modification	3.9764	0.00021165

From the above results we can find that the total deformation and equivalent stress after modification are less when compared to before modification so the newly designed is efficient when compared to old dripper.

It is hoped that the productivity of drippers will be increased by replacing long drippers with short drippers. The initial investment cost for same number of drippers is less for short drippers compared to long drippers. Short drippers can be sold out at reasonable price for farmers enabling them to increase production.

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