

SIMULATION COMPARISON AND STEPS TO DO SIMULATION BY AUTOLISP (AUTOCAD) AND PRO-E FOR GEAR PAIR.

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Abstract:

This paper gives the basic idea of steps required for doing simulation in AutoCAD with the help of AutoLisp and Pro-Engineering. It includes the comparison between both methods. AutoCAD 2005 and Pro-E wildfire V4.0 used as software to do simulation (Animation).

Keywords: AutoCAD, AutoLisp, Pro-E, Simulation.

INTRODUCTION

Simulation is a sequence of 2D and 3D image with some constant or fluctuating time delay. Here in this paper we have used AutoCAD and Pro-E as simulation software.

AutoCAD is a software application for computer-aided design (CAD) and drafting in both 2D and 3D. It is developed and sold by Autodesk, Inc. first released in December 1982 by Autodesk, AutoCAD was one of the first CAD programs to run on personal computers.

Pro/E is large engineering software which is marketed by Parametric Technology Corporation (Abbreviation PTC), which integrates the part design, assembly of product, Mechanism design/analysis, the dynamic simulation etc.

To do simulation in AutoCAD knowledge of Auto Lisp is necessary while in Pro-E knowledge of mechanism and constraint are necessary. To do comparison lets first know how to do simulation. Below are the steps and explanation for simulation.

A. STEPS FOR SIMULATION IN AUTOCAD.

1. Prepare a 2D sketch of spur gear pair
2. Make a 3D model from 2D.
3. Write an AutoLisp program for simulation.
4. Call command made by AutoLisp.

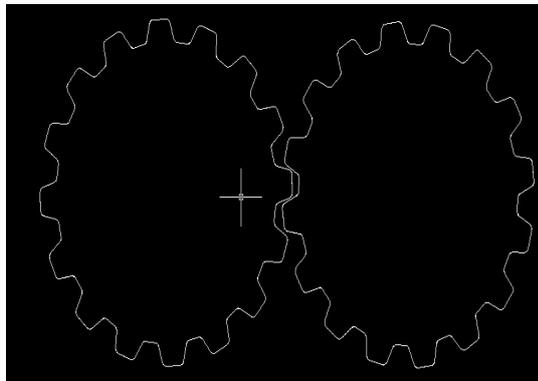
B. STEPS FOR SIMULATION IN PRO-ENGINEERING.

1. Prepare a 3D model.
2. Open it in assembly file.
3. Define the constraints.
4. Define the Mechanism.
5. Do the analysis of Mechanism.
6. Play/Run sequence.

(A) STEPS FOR SIMULATION IN AUTOCAD.

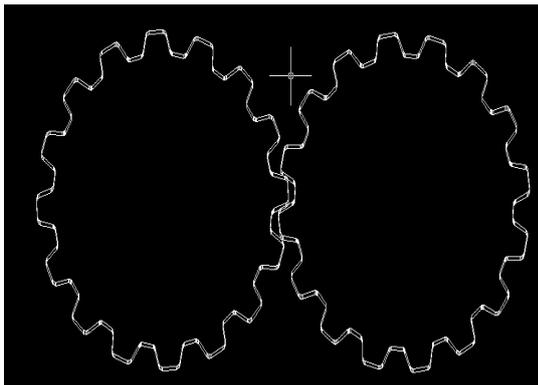
- (1) Prepare a 2D sketch AutoCAD

First gear with center point “300,800” and other gear with center point “1259.19, 793.59”.Center point is mentioned here because it is required as a base point for “Rotate” command during AutoLisp programming. Bellow figure show look of that gear.



- (2) Make 3D from 2D drawing.

With the use “Extrude” command we have make a 3D figure as shown below. The value of depth of extrude is 40mm.



(3) Write an AutoLisp program

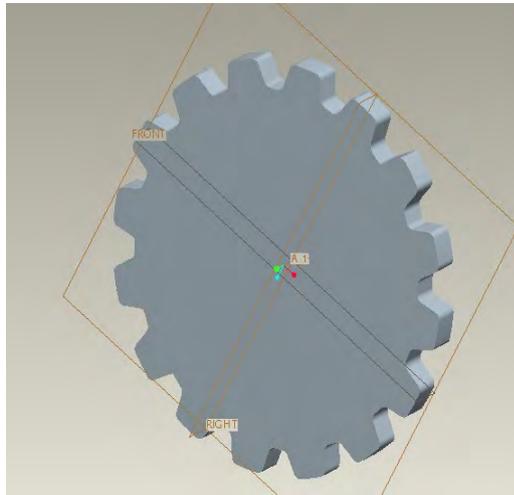
```
(
defun c: gearani()
(setq x (car (entsel)))
(setq y (car (entsel)))
(setq i 1)
(repeat 360
(progn
(setq r1 (* i (/ 3.14 180)))
(command "rotate" x "" "300,800" r1)
(command "rotate" y "" "1259.19,
793.59" (* r1 -1))
(setq i (+ i 1))
(repeat 10000)
)))
```

(4) Call the command.

- On above program we have made a command “gearani”. On command window write the command gearani, it will ask for select first entity as an answer select gear one. Again it will ask for select second entity two as an answer select second gear.
- Now press enter your simulation start.

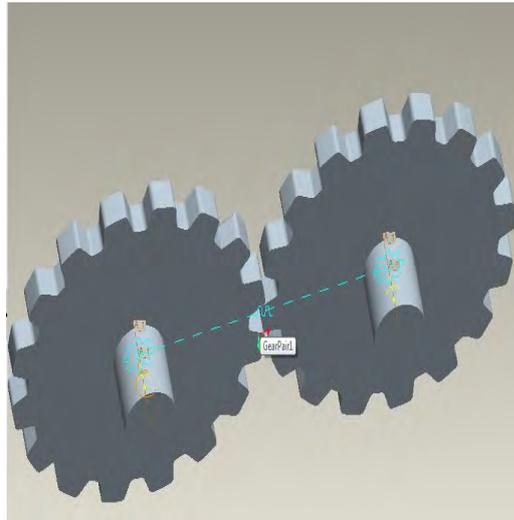
(B) STEPS FOR SIMULATION IN PRO-ENGINEERING.

(1) Make a 3D model of one gear and save it. In Pro-E. Our model looks like bellow.

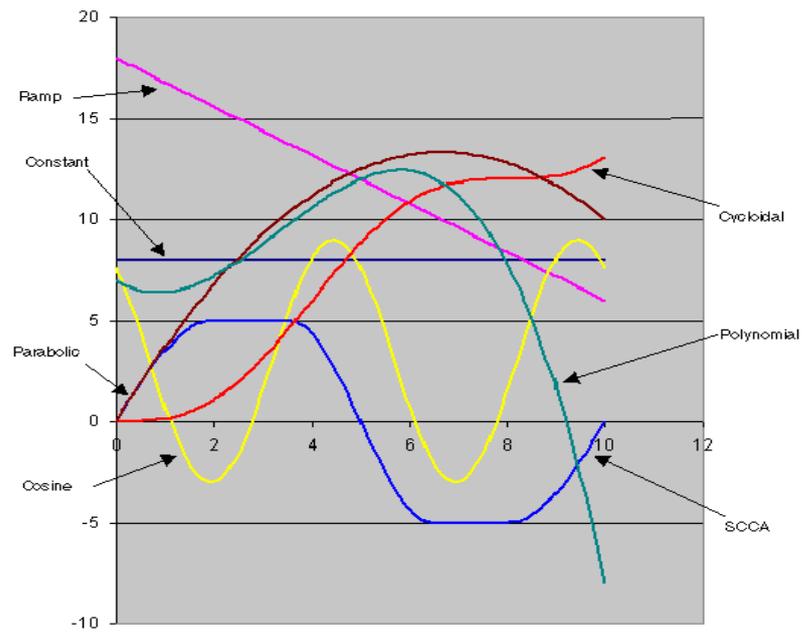


- (2) Make a support on which our gears rotate. Now start giving constraints for our gear. It is done in assembly. Create new assembly file. Call the part which is created for gear support next call the gear part and define the constraint which is required to develop the mechanism of gear pair. To run the simulation of mechanism of gear pair you required “Pin joint at both gear” and “Servo Motor” attachment at any one of gear. Pin Joint is given between support and gear. Pin joint required rotary constraint and Translation constraint.
- (3) Now open mechanism in Pro-E and define the mechanism. In our case we have to select gear pair mechanism. For Gear pair mechanism we required the pin joint at both gear and pitch circle diameter. For rotation we required to put servo motor on one of the pin joint. Select velocity with constant value in servo motor profile. There are also different profiles available for servo motor in Pro-E.

After doing all this figure looks like bellow.



- (4) Define the properties of servo motor .In our case we have taken a constant velocity servo motor. An advantage of servo motor is it has a different profile like Position, Velocity and Acceleration. All this profile has a sub properties likes Constant, Cosine, Cycloid, Parabolic, Ramp, etc. All are work on different equation. All sub profile is shown below.



Below are the value taken to generate above graph.

Constant	Ramp	Cosine	Cycloidal	SCCA	Parabolic	Polynomial
A = 8	A = 18	A = 6	L = 12	0.4	A = 4	A = -0.1
	B = -1.2	B = 40	T = 8	0.3	B = -0.6	B = 1
		C = 3		5		C = -1.5
		T = 5		10		D = 7

COMPARISON:

Simulation done by AutoLisp (AutoCAD).

Advantage:

- Same program used for different object as having no intelligence.
- It does not require any constraints and mechanism to do simulation.
- Speed of simulation easily changes.
- Low Cost of Software.
- In same window you will able to do simulation for another gear pair also.

Disadvantage:

- It's operating in a sequence of line written in AutoLisp so true simulation is not possible.
- Writing an AutoLisp program require programming knowledge and logic so it is not user friendly.
- It not gives an error even if object interference occurs.
- No intelligence.

Simulation done by Pro-E.

Advantage:

Gives realistic and smoother simulation.

It is intelligent as it gives error if mechanism or constraint doesn't fill full the condition required.

Have a variety of option to control the rotary motion because having a different profile of servo motor.

Disadvantage:

High Cost of Software.

You can't use the same mechanism and constraints to do simulation for another object for simulation which are in one window.

CONCLUSIONS

From this work we conclude that in AutoLisp, simulation not gives the smoother performance because it's operate on sequence of line written in program and also it having no intelligence so not safe for mechanism design while in Pro-E simulation work smoothly and look likes realistic and also safe for mechanism design as it give error if any type of interference occurs in two parts also plotting of different graph for different measure of analysis are useful for mechanism analysis.

REFERENCES

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