101年大學部國際交流甄選專題成果展

The Analysis of Crack Gear

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➢ Abstract

Nowadays, gear is the most important mechanism used for motion and power transmission. The different method of fault will cause gear to be damaged, such as fatigue failure, vibration, and other weather conditions. So, to detect and protect the gear are the most important thing.

➢ Motivation

The reason which cause the gear damaged are numerous. In this project, I want to find the method to separate the different between the broken gear and the normal. Then, I focus on the crack gear, and I try to analysis the stiffness between the crack and the normal.

➢ Modeling

◆ Gear

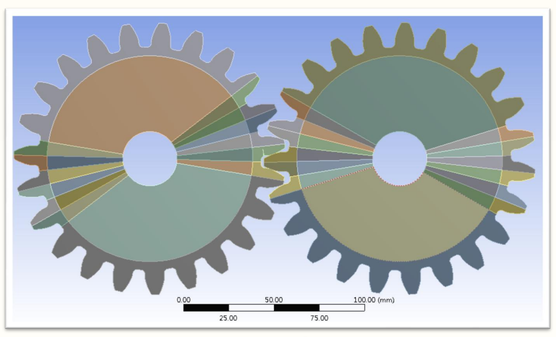

Fig.1 involute gear

Name	Sign	Value
Module	m	6(mm)
Tooth number	z	23
Pitch	p	18.8495(mm)
Pitch circle	r	69(mm)
Basic circle	r_b	64.838(mm)
Addendumof basic rack	h_a	6(mm)
Dedendum of basic rack	h_f	7.5(mm)
Tooth depth of basic rack	h	13.5(mm)
Clearance	c	1.5(mm)
The depth of gear	t	15(mm)
Pressure angle	a	20

Fig.2 gear data

◆ Crack

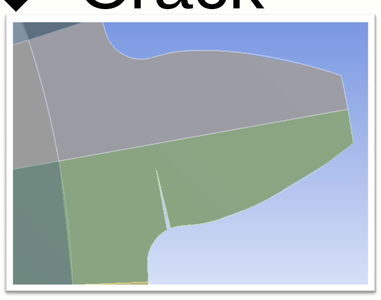

Fig.3 the crack of gear

Determine the crack：

$$\alpha = \frac{the\ length\ of\ crack}{the\ depth\ of\ gear(t)} = 0.25$$

$$\beta = \frac{the\ distace\ of\ crack\ and\ root}{tooth\ depth\ \ of\ basic\ rack(h)} = 0.11$$

◆ Boundary Condition

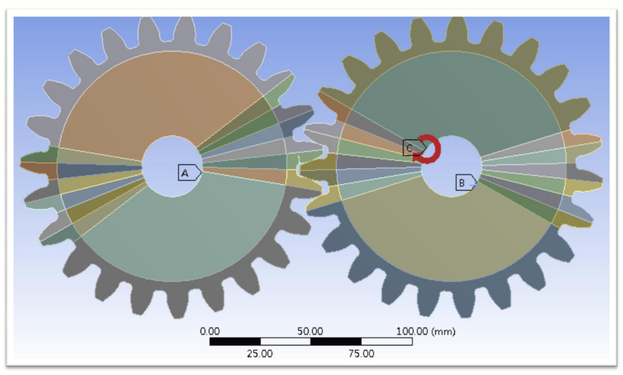

Fig.4 B.D. of gear

A：Fix Support
B：Frictional Support
C：Moment 100N·m

- Divided the contact region of crack tooth into 20 steps.
- Get the displacement and force of the crack tooth.
- Using the equation $k=\frac{F}{\delta}$ to solve the stiffness of the gear.

➢ Result&Discussion

Fig.5 stress distribution

Fig.7 Contact region (crack)

Fig.8 y-direction displacement distribution

- In Fig.5, the maximum von-Mises stress takes place in the contact region not in the crack region.
- In the Fig.6 and Fig.7, the crack of tooth and the contact region both have the stress concentration.

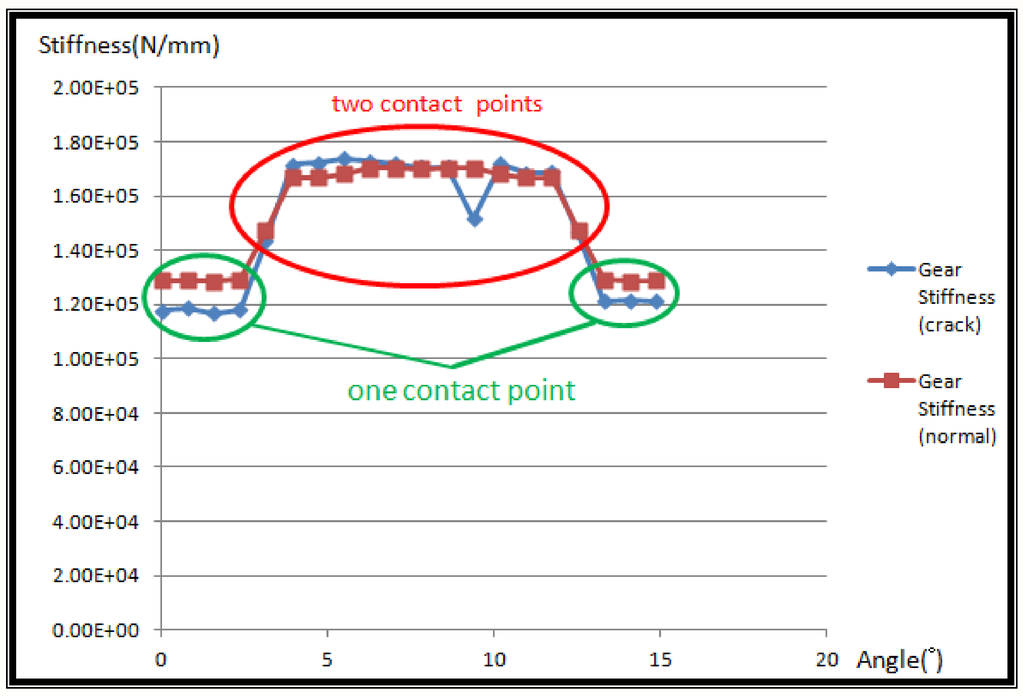

Fig.7 the stiffness of the gear

- In the Fig.7 , we see the stiffness of the crack one smaller than the normal one in one contact region .

➢ Conclusion

- According to the result, we know the gear faults would affect the stiffness of the gear.
- Different faults would appear different profile.
- As a result, we can use it as a basic data to develop the machine which can detect the faults of the gear.