



HW03

第03章 齿轮传动设计 (上)

作业参考答案

南方科技大学

HW 03.1

- 试设计一对外啮合渐开线直齿圆柱齿轮，已知传动比 $i_{12} = 2.03$ ，标准中心距 $a = 150 \text{ mm}$ ，模数 $m = 3 \text{ mm}$ 。若将中心距较标准中心距增大 1.5 mm ，求齿顶间隙 c' ，节圆半径 r'_1 、 r'_2 及啮合角 a' 。
- Design a pair of cylindrical spur gears with involute tooth profile. The gear transmission ratio is $i_{12} = 2.03$, the standard distance between gear centers is $a = 150 \text{ mm}$, the modules is $m = 3 \text{ mm}$. If increasing the the standard distance between gear centers by 1.5 mm , please calculate the clearance c' , pitch circle radius r'_1 、 r'_2 and the meshing angle a'

HW 03.1

解 因为 $a = r_1 + r_2 = \frac{1}{2}m(z_1 + z_2) = 150 \text{ mm}$, $i_{12} = \frac{z_2}{z_1} = 2.03$, 由此解出

$$z_1 = 33.0033, \quad z_2 = 66.997$$

如取 $z_1 = 33, z_2 = 67$, 则可求得以下参数:

分度圆直径

$$d_1 = z_1 m = 33 \times 3 \text{ mm} = 99 \text{ mm}$$

$$d_2 = z_2 m = 67 \times 3 \text{ mm} = 201 \text{ mm}$$

基圆直径

$$d_{b1} = d_1 \cos \alpha = 99 \text{ mm} \times \cos 20^\circ = 93.02 \text{ mm}$$

$$d_{b2} = d_2 \cos \alpha = 201 \text{ mm} \times \cos 20^\circ = 188.94 \text{ mm}$$

齿顶圆直径

$$d_{a1} = d_1 + 2h_a = (99 + 2 \times 3) \text{ mm} = 105 \text{ mm}$$

$$d_{a2} = d_2 + 2h_a = (201 + 2 \times 3) \text{ mm} = 207 \text{ mm}$$

齿根圆直径

$$d_{f1} = d_1 - 2h_f = (99 - 2 \times 3.75) \text{ mm} = 91.5 \text{ mm}$$

$$d_{f2} = d_2 - 2h_f = (201 - 2 \times 3.75) \text{ mm} = 193.5 \text{ mm}$$

HW 03.1

- 若将安装中心距较标准中心距增大 1.5 mm, 则应有

$$a' = a + 1.5 \text{ mm} = 151.5 \text{ mm}$$

因为 $a' = r'_1 + r'_2$, $i_{12} = \frac{r'_1}{r'_2} = \frac{z_2}{z_1}$, 故节圆半径可分别求得为

$$r'_1 = \frac{a'}{1 + i_{12}} = \frac{151.5}{1 + \frac{67}{33}} \text{ mm} = 50 \text{ mm}$$

$$r'_2 = a' - r'_1 = (151.5 - 50) \text{ mm} = 101.5 \text{ mm}$$

啮合角为

$$\alpha' = \arccos \frac{r_{b2}}{r'_2} = \arccos \frac{94.47}{101.5} = 21.5^\circ$$

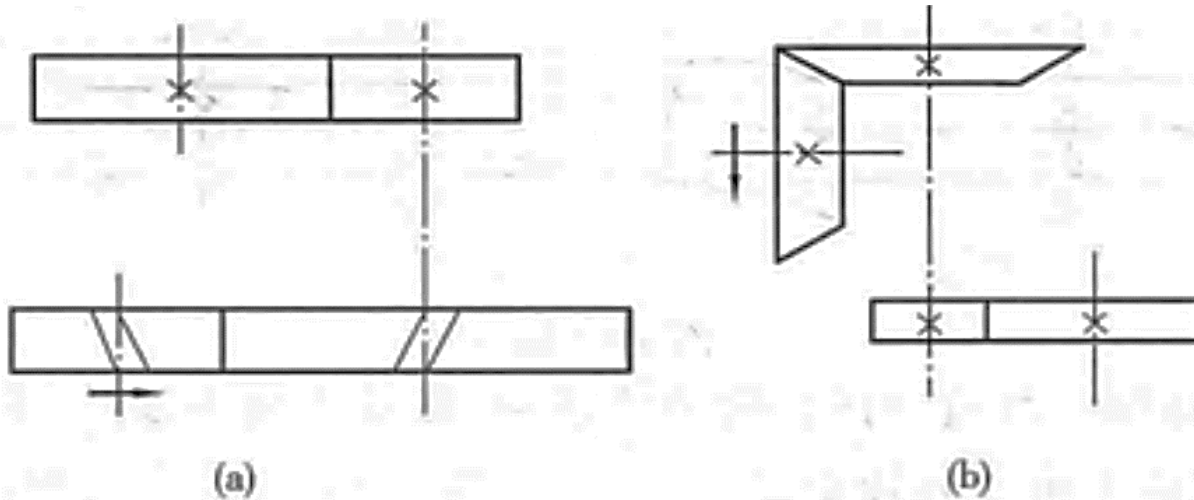
齿顶间隙为

$$c' = (a' - a) + c = [(151.5 - 150) + 0.25 \times 3] \text{ mm} = 2.25 \text{ mm}$$

此例说明, 中心距的分离使啮合角发生了变化, 并介绍了节圆半径的求法。

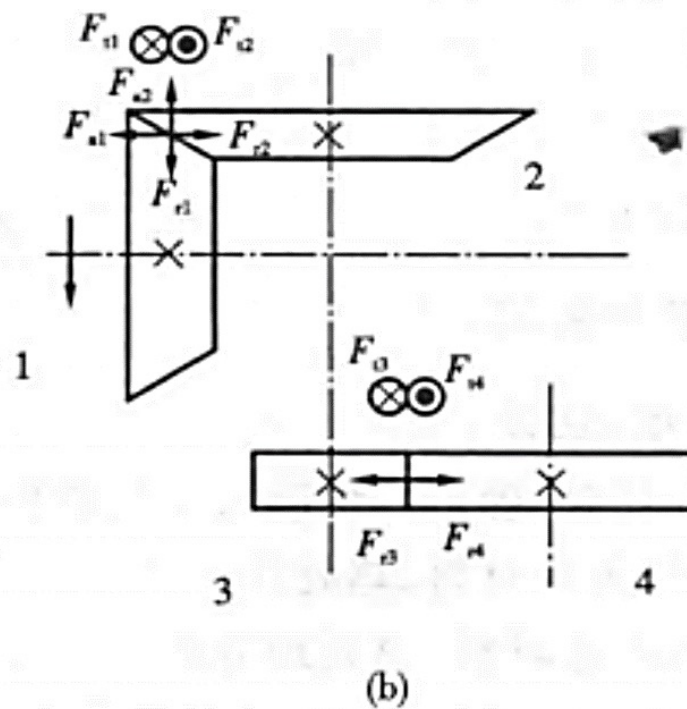
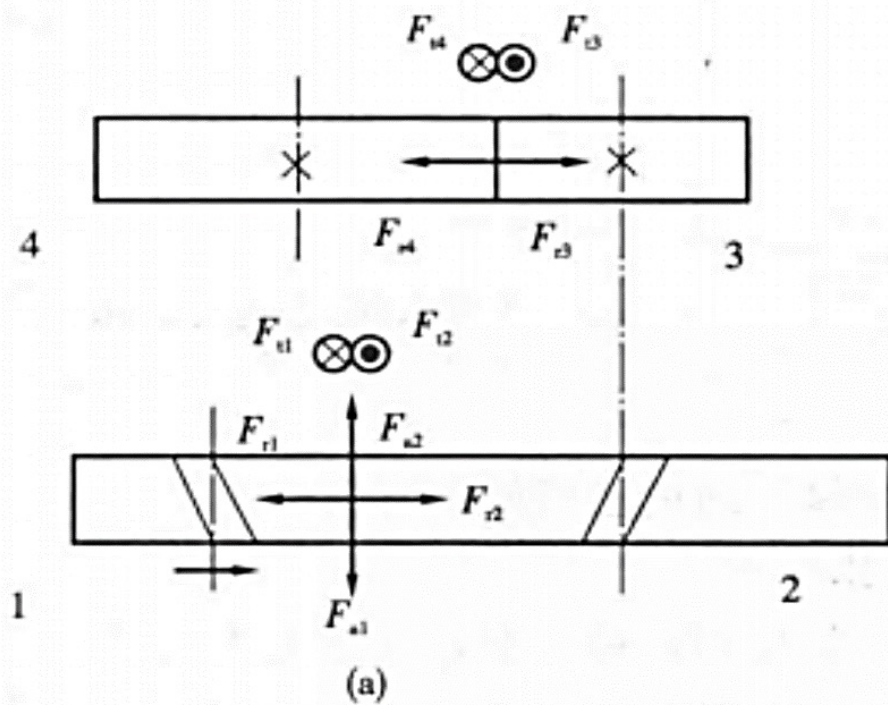
HW 03.2

- 试分析如下图所示齿轮传动中个齿轮的受力情况，并用受力图表示出各分力的作用位置、方向及齿轮转向



- Try to analyze the following figure shows the gear transmission in the gear force situation, and use the force diagram to indicate the location of the action of each component force, direction and gear steering

HW 03.2





ME311: 机械设计

2023年秋季

Deadline of this homework: Oct 24 @ **23:30**

Link to submission:

https://ancorasir.com/?page_id=3987

All homework MUST be hand-written.

No late submission is allowed!

Please refer to the above link for further details on how to make the submission and the detailed deadline for submission.

谢谢~

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