

第2章 汇交力系

§2.2 汇交力系合成的解析法

二、汇交力系合成的解析法

合力等于各分力的矢量和： $\vec{F}_R = \sum \vec{F}_i$

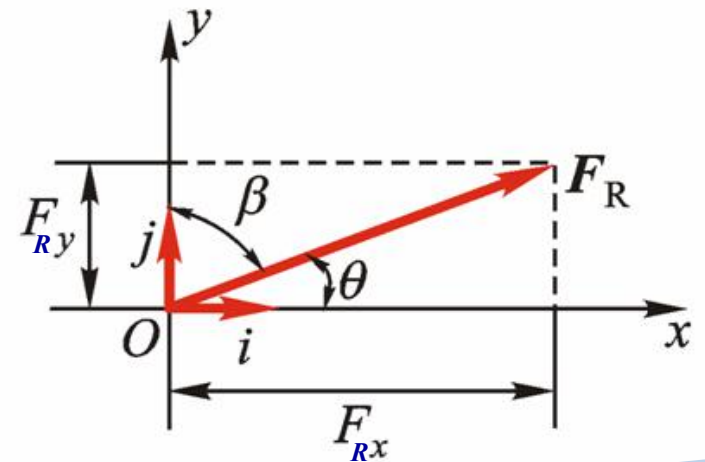
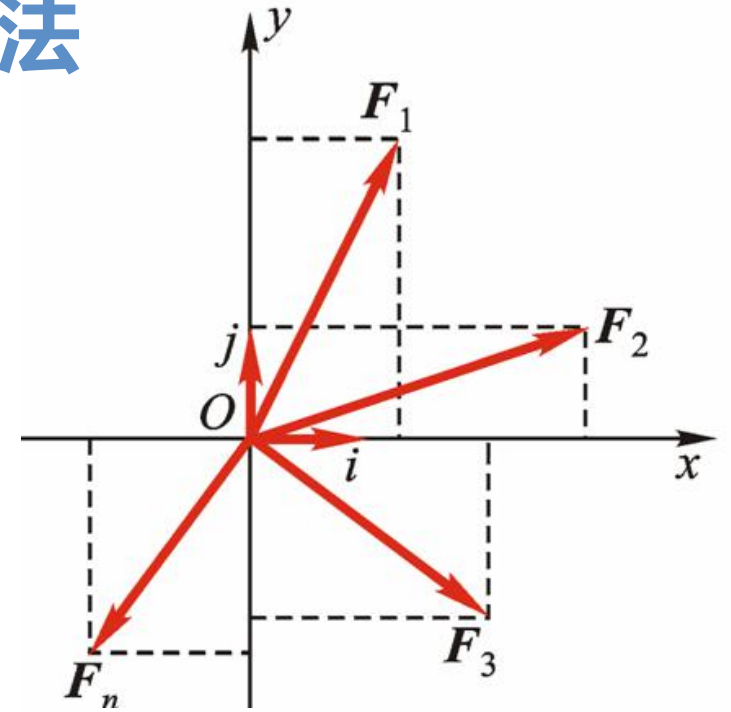
合力 \vec{F}_R 在 x, y 轴上的投影分别为： F_{Rx}, F_{Ry}

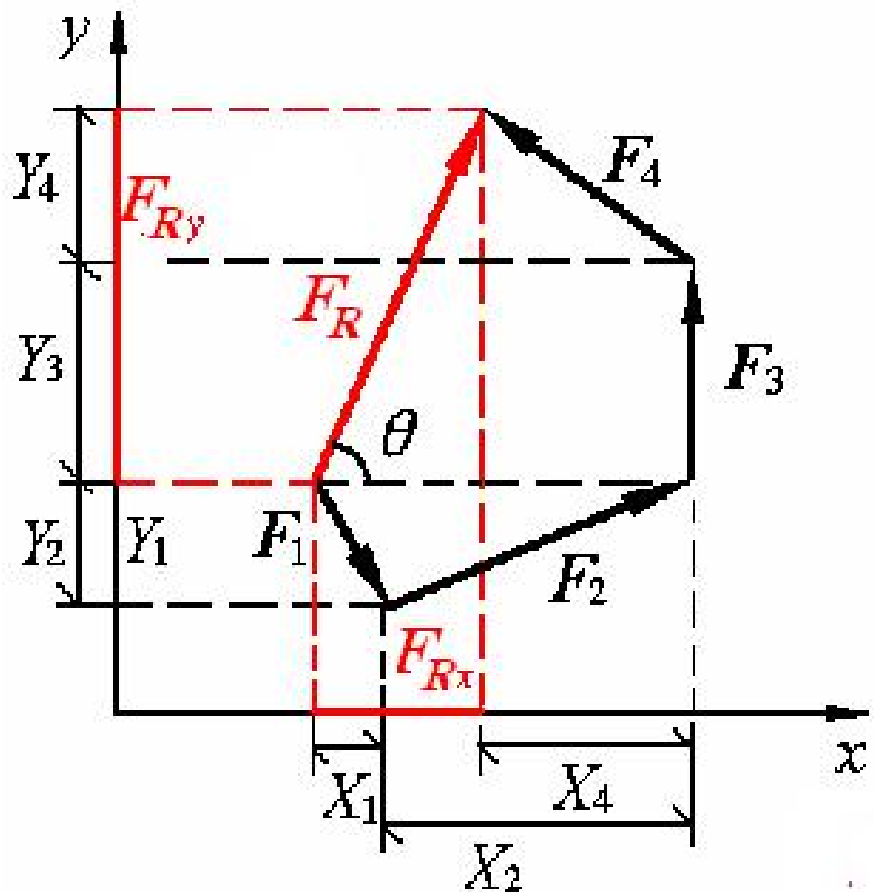
合力投影定理：

各分力在 x, y 轴投影的代数和，
等于合力在对应轴上的投影。

$$F_{Rx} = \sum F_{ix}$$

$$F_{Ry} = \sum F_{iy}$$





各分力在 x 轴和在 y 轴投影的代数和
等于合力在对应轴上的投影。

$$F_{Rx} = X_1 + X_2 - X_4 = \sum X_i$$

$$F_{Ry} = -Y_1 + Y_2 + Y_3 + Y_4 = \sum Y_i$$

汇交力系的合力解析表达式:

$$\vec{F}_R = F_{Rx} \vec{i} + F_{Ry} \vec{j}$$

合力的大小:

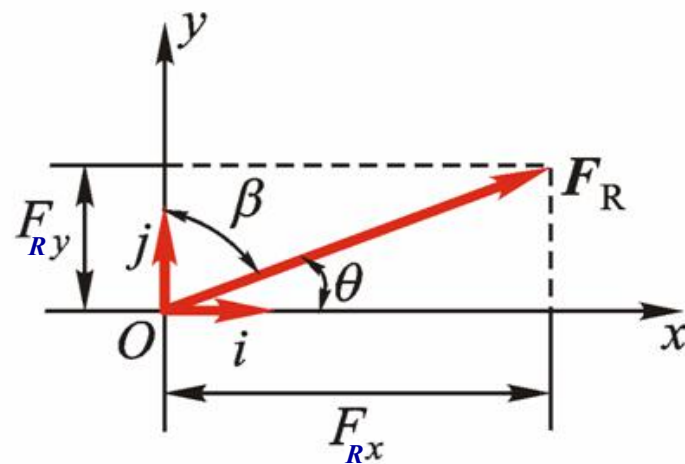
$$F_R = \sqrt{F_{Rx}^2 + F_{Ry}^2}$$

合力作用点: 为该力系的汇交点

合力的方向:

$$\cos(\vec{F}_R, \vec{i}) = \frac{F_{Rx}}{F_R}$$

$$\cos(\vec{F}_R, \vec{j}) = \frac{F_{Ry}}{F_R}$$



[例] 已知：图示平面共点力系， $F_1 = 200\text{N}$ $F_2 = 300\text{N}$

$$F_3 = 100\text{N} \quad F_4 = 250\text{N}$$

求：此力系的合力。

解：用解析法

$$F_{Rx} = \sum F_{ix} = F_1 \cos 30^\circ - F_2 \cos 60^\circ - F_3 \cos 45^\circ + F_4 \cos 45^\circ = 129.3\text{N}$$

$$F_{Ry} = \sum F_{iy} = F_1 \sin 30^\circ + F_2 \sin 60^\circ - F_3 \sin 45^\circ - F_4 \sin 45^\circ = 112.3\text{N}$$

$$F_R = \sqrt{F_{Rx}^2 + F_{Ry}^2} = 171.3\text{N}$$

$$\cos \theta = \frac{F_{Rx}}{F_R} = 0.7548 \quad \cos \beta = \frac{F_{Ry}}{F_R} = 0.6556$$

$$\theta = 40.99^\circ, \quad \beta = 49.01^\circ$$

