2、牵连运动为转动时点的加速度合成定理

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$$\vec{a}_r = \frac{\tilde{\mathrm{d}}^2\vec{r}\,'}{\mathrm{d}t^2} = \ddot{x}'\vec{i}\,' + \ddot{y}'\vec{j}\,' + \ddot{z}'\vec{k}\,'$$

$$\vec{a}_e = \frac{\mathrm{d}^2\vec{r}_{M'}}{\mathrm{d}t^2} = \ddot{\vec{r}}_{O'} + x'\ddot{\vec{i}}\,' + y'\ddot{\vec{j}}\,' + z'\ddot{\vec{k}}\,'$$

$$\vec{a}_a = \frac{\mathrm{d}^2\vec{r}_M}{\mathrm{d}t^2}$$

$$= \ddot{\vec{r}}_{O'} + x'\ddot{\vec{i}}\,' + y'\ddot{\vec{j}}\,' + z'\ddot{\vec{k}}\,'$$

$$+ \ddot{x}'\vec{i}\,' + \ddot{y}'\vec{j}\,' + \ddot{z}'\vec{k}\,'$$

$$+ 2(\dot{x}'\dot{\vec{i}}\,' + \dot{y}'\dot{\vec{j}}\,' + \dot{z}'\dot{\vec{k}}\,')$$

$\vec{a}_e$

$\vec{a}_r$

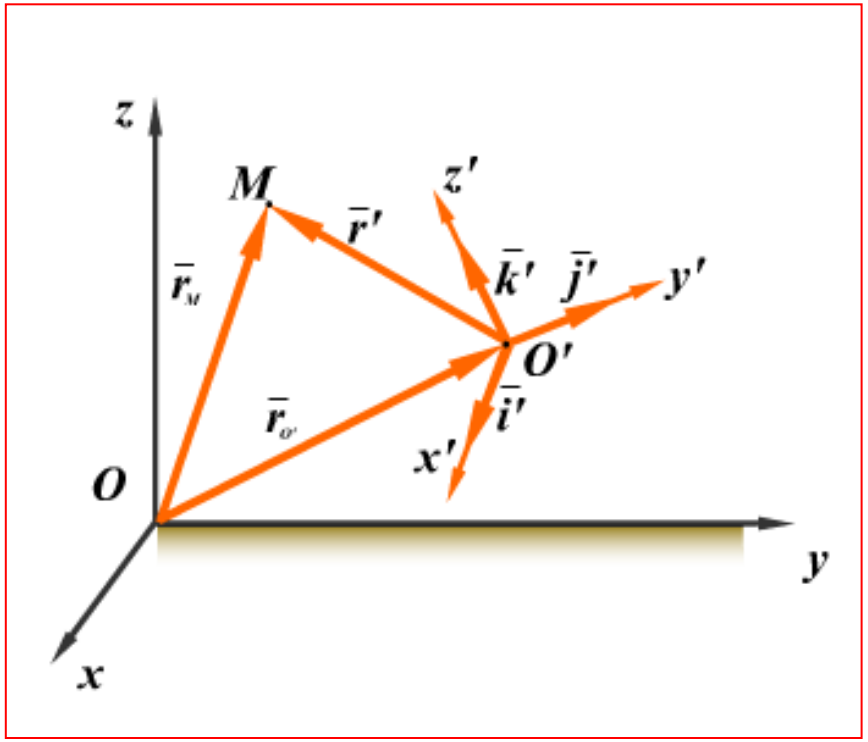
?

$$\vec{v}_a = \frac{\mathrm{d}\vec{r}_M}{\mathrm{d}t} = \dot{\vec{r}}_{O'} + x'\dot{\vec{i}}\,' + y'\dot{\vec{j}}\,' + z'\dot{\vec{k}}\,'$$

$$+ \dot{x}'\vec{i}\,' + \dot{y}'\vec{j}\,' + \dot{z}'\vec{k}\,'$$

$$\vec{v}_r = \frac{\tilde{\mathrm{d}}\vec{r}\,'}{\mathrm{d}t} = \dot{x}'\vec{i}\,' + \dot{y}'\vec{j}\,' + \dot{z}'\vec{k}\,'$$

$$\vec{v}_e = \dot{\vec{r}}_{O'} + x'\dot{\vec{i}}\,' + y'\dot{\vec{j}}\,' + z'\dot{\vec{k}}\,'$$



设动系作定轴转动，转轴通过点O，其角速度矢量为 $\vec{\omega}_e$

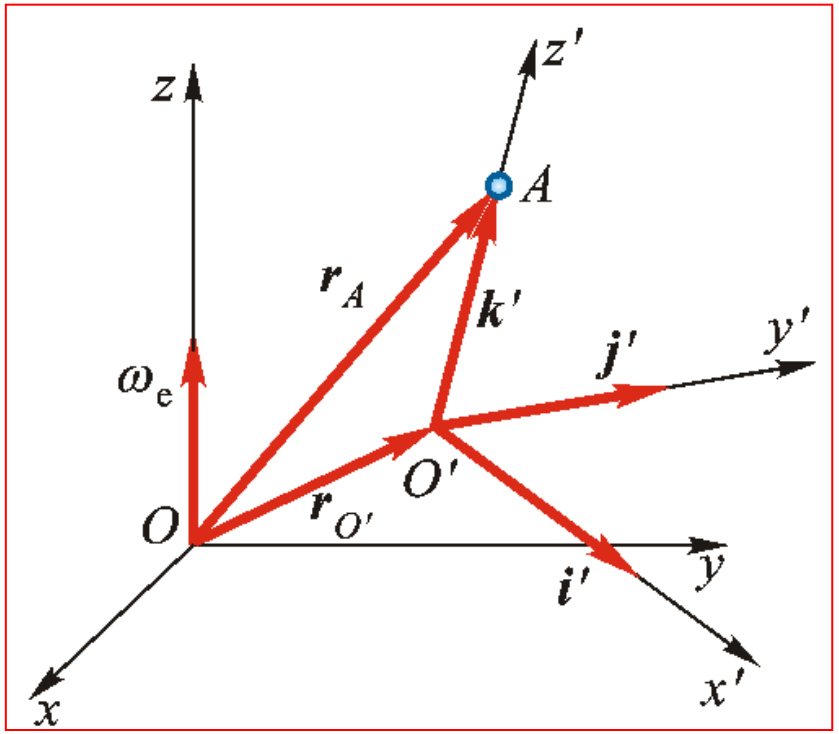
$$\vec{r}_A = \vec{r}_{o'} + \vec{k}' \quad \Rightarrow \quad \frac{\mathrm{d}\vec{r}_A}{\mathrm{d}t} = \frac{\mathrm{d}\vec{r}_{O'}}{\mathrm{d}t} + \frac{\mathrm{d}\vec{k}'}{\mathrm{d}t} \quad \Rightarrow \quad \vec{v}_A = \vec{v}_{O'} + \frac{\mathrm{d}\vec{k}'}{\mathrm{d}t}$$

$$\vec{v}_A = \vec{\omega}_e \times \vec{r}_A$$

$$\vec{v}_{O'} = \vec{\omega}_e \times \vec{r}_{O'}$$

$$\frac{\mathrm{d}\vec{k}'}{\mathrm{d}t} = \vec{v}_A - \vec{v}_{O'} = \vec{\omega}_e \times (\vec{r}_A - \vec{r}_{O'})$$

$$\Rightarrow \quad \frac{\mathrm{d}\vec{k}'}{\mathrm{d}t} = \vec{\omega}_e \times \vec{k}'$$



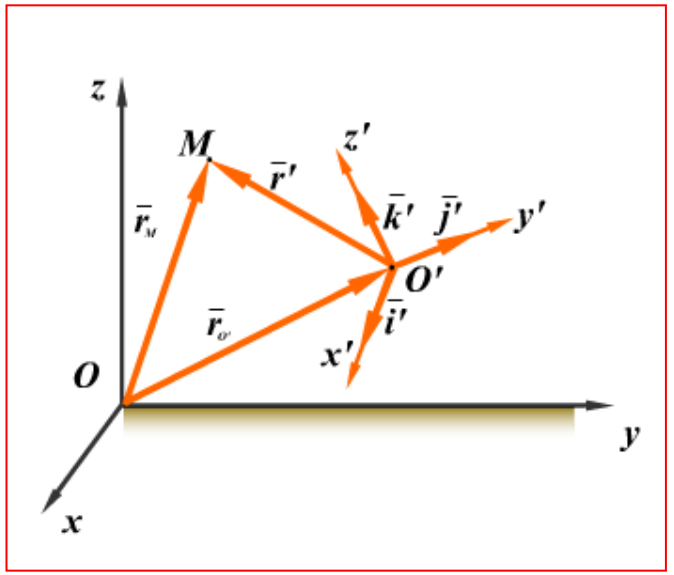
$$\frac{\mathrm{d}\vec{i}'}{\mathrm{d}t} = \vec{\omega}_e \times \vec{i}' \qquad \frac{\mathrm{d}\vec{j}'}{\mathrm{d}t} = \vec{\omega}_e \times \vec{j}'$$

$$2(\dot{x}'\vec{i}'+\dot{y}'\vec{j}'+\dot{z}'\vec{k}')$$

$$=2\left[\dot{x}'\left(\vec{\omega}_e\times\vec{i}'\right)+\dot{y}'\left(\vec{\omega}_e\times\vec{j}'\right)+\dot{z}'\left(\vec{\omega}_e\times\vec{k}'\right)\right]$$

$$=2\vec{\omega}_e\times\left(\dot{x}'\vec{i}'+\dot{y}'\vec{j}'+\dot{z}'\vec{k}'\right)=2\vec{\omega}_e\times\vec{v}_r$$

$\vec{a}_C=2\vec{\omega}_e\times\vec{v}_r$ 称为科氏加速度

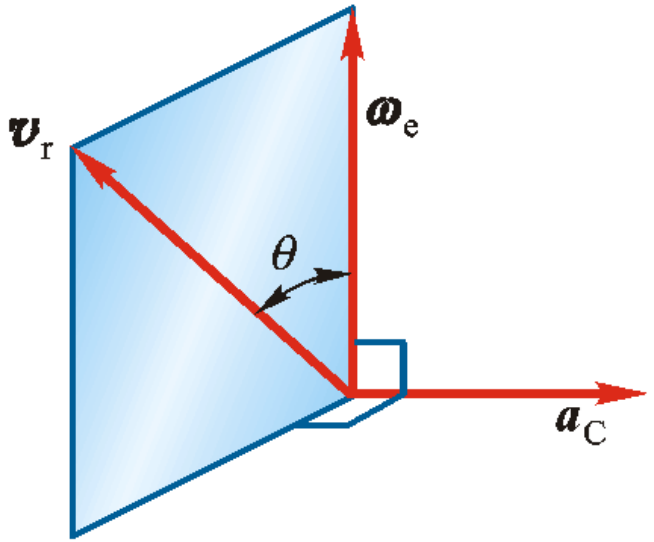


$$\vec{a}_a=\vec{a}_e+\vec{a}_r+\vec{a}_C$$

当动系作定轴转动时，动点在某瞬时的绝对加速度等于该瞬时它的牵连加速度、相对加速度与科氏加速度的矢量和

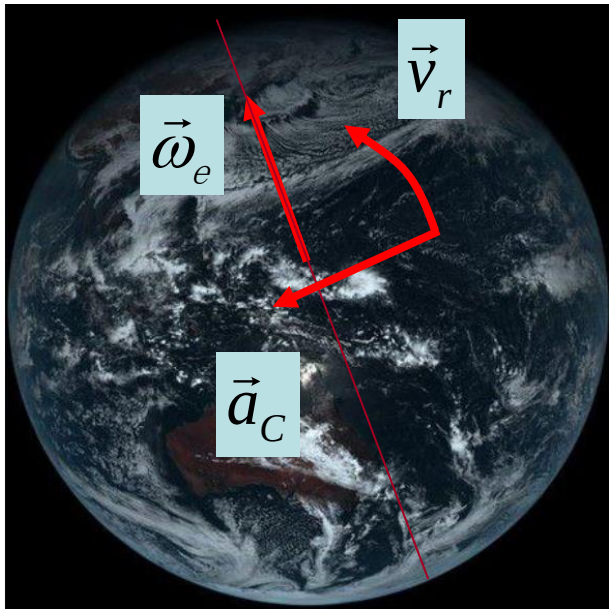
$$a_C = 2\omega_e v_r \sin\theta$$

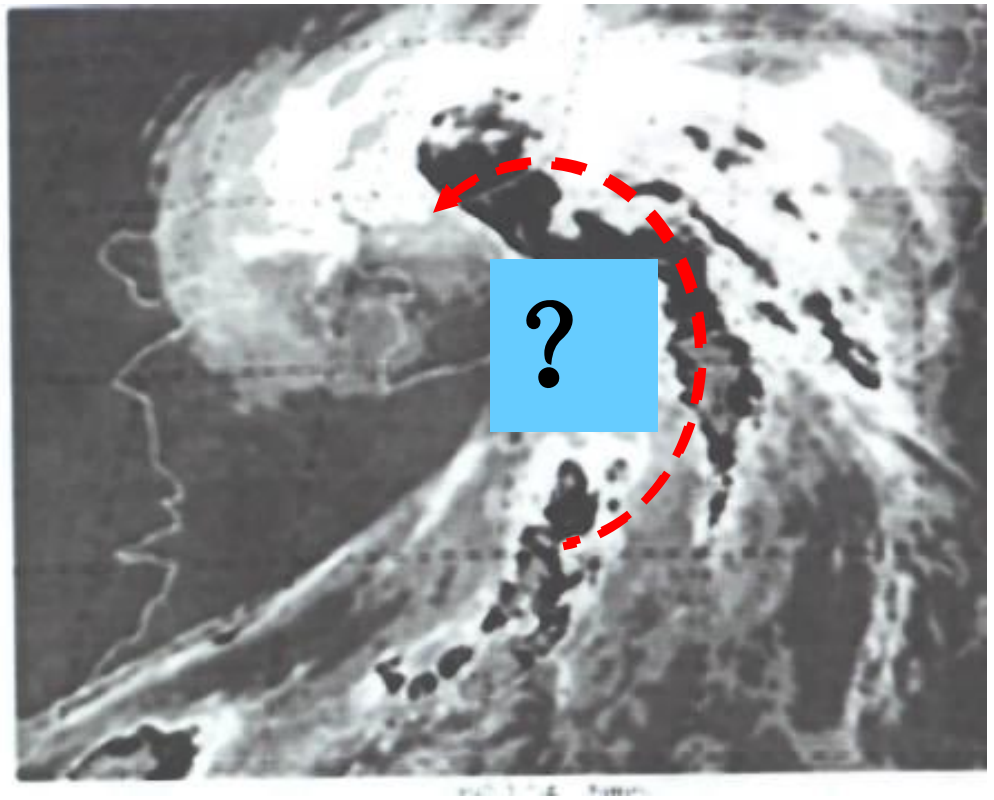
方向按右手法则确定

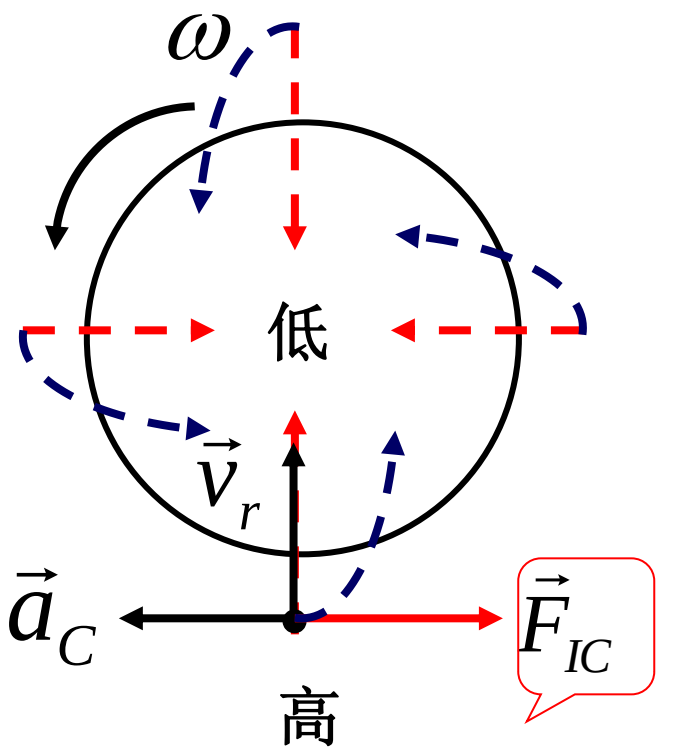


科氏加速度是1832年由科里奥利发现的，因而命名为科里奥利加速度，简称科氏加速度。

地理学的规律：北半球，河水向北流动，右岸受到较明显冲刷。







科氏惯性力

落体偏东现象;

浴缸放水时候产生的旋涡;

牵牛花盘绕生长的方向;

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寻找相似的例子，并给出合理的解释