The circular disk $B$ of radius $r$ rolls without slipping in a circle of radius $b$ on the fixed disk $C$. Write expressions for the angular velocity $\omega$ and the angular acceleration $\alpha$ of disk $B$ if its axle rotates about the vertical $z$-axis at the constant angular velocity $\omega_0$.

Problem 7/18

If disk $C$ in Prob. 7/18 rotates clockwise with a constant angular velocity $\Omega$ about the $z$-axis when viewed from above and the angular rate $\omega_0$ of $OA$ remains unchanged, determine expressions for the angular velocity $\omega$ and angular acceleration $\alpha$ of disk $B$.

Ans. $\omega = -\frac{b}{r}(\omega_0 + \Omega)\hat{i} + \omega_0\hat{k}$

$\alpha = -\frac{b}{r}\omega_0(\omega_0 + \Omega)\hat{j}$

Problem 7/19

Two bevel gears attached to the arm $C$ roll on the fixed gear $A$. The arm rotates about the $z$-axis at the constant angular velocity of 25 rad/s. Complement (a) the angular velocity of gear $B$, and (b) the angular acceleration of gear $B$.

The solid right-circular cone of base radius $r$ and height $h$ rolls on a flat surface without slipping. The center $B$ of the circular base moves in a circular path around the $z$-axis with a constant speed $v$. Determine the angular velocity $\omega$ and the angular acceleration $\alpha$ of the solid cone.

Ans. $\omega = \frac{1}{\sqrt{\frac{h^2}{r^2} + \frac{h^2}{r^2}}} \hat{i}$

$\alpha = -\frac{v^2}{h^2} \left( \frac{r}{h} + \frac{h}{r} \right) \hat{j}$

Problem 7/27

The wheel of radius $r$ is free to rotate about the bent axle $CO$ which turns about the vertical axis at the constant rate $p$ rad/s. If the wheel rolls without slipping on the horizontal circle of radius $R$, determine the expressions for the angular velocity $\omega$ and angular acceleration $\alpha$ of the wheel. The $x$-axis is always horizontal.

Ans. $\omega = p \left( \sin \theta + \frac{R}{r} \right) \hat{j}$

$\alpha = \left( \frac{p^2\cos \theta}{r} \right) \hat{i}$

Problem 7/49

Two bevel gears attached to the arm $C$ roll on the fixed gear $A$. The arm rotates about the $z$-axis at the constant angular velocity of 25 rad/s. Complement (a) the angular velocity of gear $B$, and (b) the angular acceleration of gear $B$.

Problem 7/19

Gears $A$ and $B$ spin freely on the bent shaft $D$, whereas gear $C$ is fixed. The shaft $D$ rotates about the $y$-axis with the constant angular velocity $\omega_0$. For the position shown, calculate the angular velocity of (a) gear $A$, and (b) gear $B$.

Fig. P19.11

Fig. P19.12