

## Tutorial 2

**Problem 1.** A wheel (diameter 3 m) has an initial rotational velocity of  $\omega_0 = 100$  rounds/minute. It slows down to 0 with a constant rate between  $t = 0$  and  $t = 4$  s.

1. Give the angular speed  $\omega(t)$  as function of time in SI units ( $\text{s}^{-1}$ ).
2. Determine the tangential and normal acceleration of a point on the circumference of the wheel at  $t = 2$  s.

**Problem 2.** (Kleppner & Kolenkow, Ex. 1.19) By a *relative velocity*, we mean velocity with respect to a specified coordinate system. (The term velocity, alone, is understood to be relative to a coordinate system in which the observer is at rest.)

1. A point is observed to have velocity  $\mathbf{v}_A(t)$ , relative to coordinate system  $A$ . What is its velocity relative to coordinate system  $B$ , which is displaced from system  $A$  by distance  $\mathbf{R}(t)$ ?
2. Particles  $a$  and  $b$  move in opposite directions around a circle with angular speed  $\omega$ , as shown. At  $t = 0$ , they are both at the point  $\mathbf{r} = l\hat{\mathbf{j}}$ , where  $l$  is the radius of the circle. Find the velocity of  $a$  relative to  $b$ .

