25.3: Rolling Without Slipping - Two Views

Think of a hoop, mass M radius R, rolling along a flat plane at speed V. It has translational kinetic energy $\frac{1}{2}MV^2$, angular velocity $\Omega = V/R$, and moment of inertia $I = MR^2$ so its angular kinetic energy $\frac{1}{2}I\Omega^2 = \frac{1}{2}MV^2$ and its total kinetic energy is MV^2.

But we could also have thought of it as *rotating about the point of contact*—remember, that point of the hoop is momentarily at rest. The angular velocity would again be Ω, but now with moment of inertia, from the parallel axes theorem, $I = MR^2 + MR^2 = 2MR^2$, giving same total kinetic energy, but now all rotational.