

20.4: Rolling Friction

A different kind of frictional force applies to rolling bodies like wheels. If a wheel rolls along the ground without slipping, there is a rolling frictional force at the point of contact between the wheel and the ground, due to the forming of chemical bonds between the wheel and the ground at that point, and the breaking of those bonds as the wheel moves along to the next point. This is not kinetic friction, because the wheel is not sliding across the ground - each point of the wheel is just momentarily in contact with the ground. The rolling frictional force is found to be, like the other two frictional forces, proportional to the normal force:

$$f_r = \mu_r n \quad (20.4.1)$$

Here f_r is the rolling frictional force, n is the normal force, and μ_r is the coefficient of rolling friction. The direction of the rolling frictional force is always opposite the direction of motion of the axis of the wheel. For example, if the wheel is rolling to the right, then the rolling frictional force points to the left.

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