

# Inertia Wheel Lab Report

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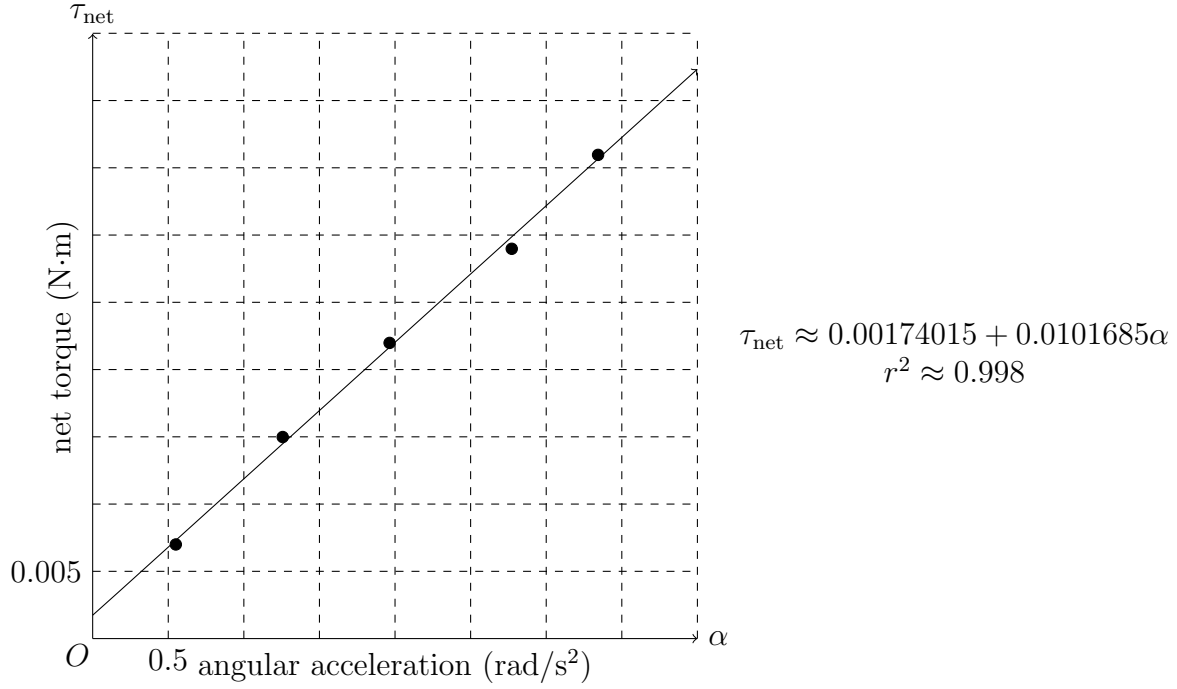
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## Data

$m_w$ (kg)	$(\Delta t)_{\text{avg}}$ (s)	$\Delta y$ (m)	$a$ (m/s <sup>2</sup> )	$\alpha$ (rad/s <sup>2</sup> )	$\tau_{\text{net}}$ (N · m)
0.02	<div> <div>96   1, 1</div> <div>97   0</div> <div>98   1, 7</div> <div>100   0</div> <div>101   6</div> <div>11   1 = 1.11</div> </div> $(\Delta t)_{\text{avg}} = 9.85$	1	$v_0 = 0$ $\Delta y = v_0 \Delta t + 0.5a(\Delta t)^2$ $= v_0(\Delta t)_{\text{avg}} + 0.5a(\Delta t)_{\text{avg}}^2$ $a = \frac{2(\Delta y - v_0(\Delta t)_{\text{avg}})}{(\Delta t)_{\text{avg}}^2}$ $= \frac{2(1 - 0)}{9.85^2} \approx 0.021$	$\alpha = \frac{a}{r_p}$ $\approx \frac{0.021}{0.125}$ $\approx 0.275$	$\tau_{\text{net}} = F_{\text{net}} \times r_p$ $= mr_p(g - a)$ $\approx 0.02(9.8 - 0.021)$ $\approx 0.007$
0.04	<div> <div>64   1</div> <div>65   0, 1, 1, 5</div> <div>66   0</div> <div>11   1 = 1.11</div> </div> $(\Delta t)_{\text{avg}} \approx 6.513$	1	$\approx 0.047$	$\approx 1.257$	$\approx 0.015$
0.06	<div> <div>49   2</div> <div>50   0, 3</div> <div>51   1</div> <div>52   0, 1, 1</div> <div>53   1</div> <div>54   0, 1, 1</div> <div>11   1 = 1.11</div> </div> $(\Delta t)_{\text{avg}} \approx 5.211$	1	$\approx 0.074$	$\approx 1.964$	$\approx 0.022$
0.08	<div> <div>42   6</div> <div>43   0</div> <div>44   1, 2, 5, 8</div> <div>11   1 = 1.11</div> </div> $(\Delta t)_{\text{avg}} \approx 5.211$	1	$\approx 0.104$	$\approx 2.772$	$\approx 0.029$
0.1	<div> <div>37   3</div> <div>38   4</div> <div>39   3</div> <div>40   1, 8</div> <div>41   0</div> <div>41   5</div> <div>11   1 = 1.11</div> </div> $(\Delta t)_{\text{avg}} \approx 3.994$	1	$\approx 0.125$	$\approx 3.343$	$\approx 0.036$

$I_{\text{net}}$

$$\begin{aligned} I_{\text{net,th}} &= 0.5m_d r_d^2 + m_p r_p^2 \\ &= 0.5(1.3)(0.125)^2 + 0.1(0.0375)^2 \\ &\approx 0.01 \text{ N} \cdot \text{m} \end{aligned}$$



$$\begin{aligned} I_{\text{net,exp}} &\approx 0.01 \\ \% \text{ error} &= \left| \frac{I_{\text{net,exp}} - I_{\text{net,th}}}{I_{\text{net,th}}} \right| \approx 1.25\% \end{aligned}$$

The reason that the least-squares regression line relating  $\tau_{\text{net}}$  to  $\alpha$  does not display direct variation is that a lack of angular acceleration may occur when torque is not great enough to overcome friction.