

Inertia Wheel Lab Report

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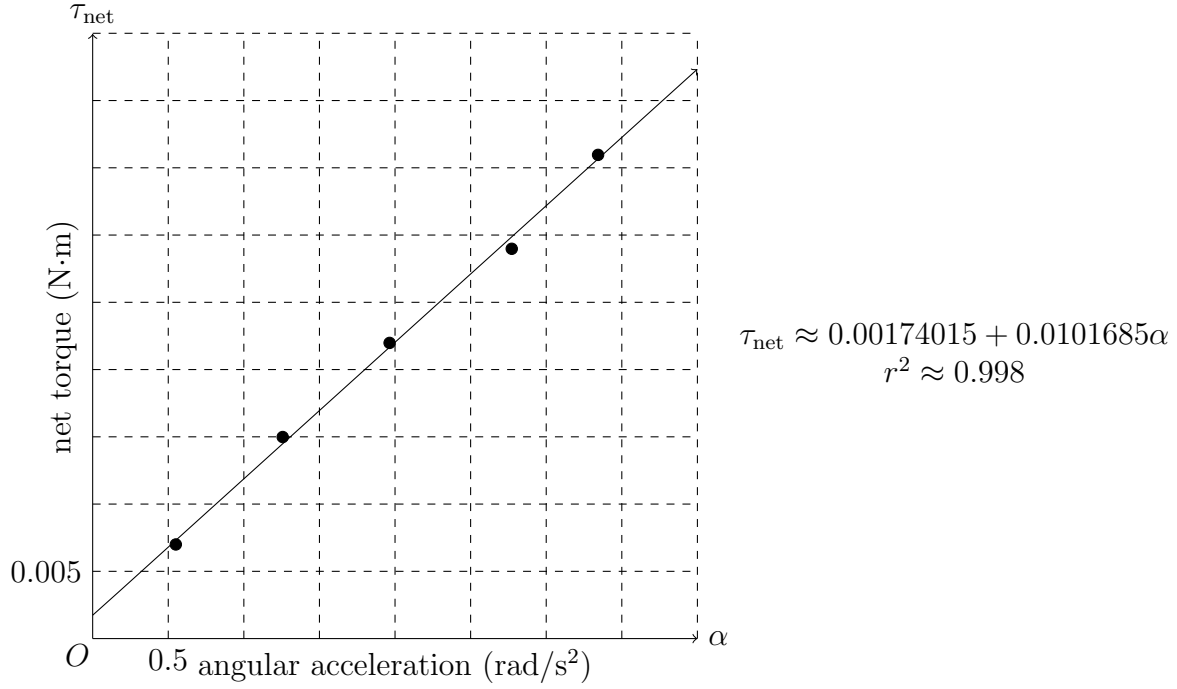
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Data

m_w (kg)	$(\Delta t)_{\text{avg}}$ (s)	Δy (m)	a (m/s ²)	α (rad/s ²)	τ_{net} (N · m)
0.02	<div> <div>96 1, 1</div> <div>97 0</div> <div>98 </div> <div>99 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	$v_0 = 0$ $\Delta y = v_0 \Delta t + 0.5a(\Delta t)^2$ $= v_0(\Delta t)_{\text{avg}} + 0.5a(\Delta t)_{\text{avg}}^2$ $a = \frac{2(\Delta y - v_0(\Delta t)_{\text{avg}})}{(\Delta t)_{\text{avg}}^2}$ $= \frac{2(1 - 0)}{9.85^2} \approx 0.021$	$\alpha = \frac{a}{r_p}$ $\approx \frac{0.021}{0.125}$ ≈ 0.275	$\tau_{\text{net}} = F_{\text{net}} \times r_p$ $= mr_p(g - a)$ $\approx 0.02(9.8 - 0.021)$ ≈ 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	≈ 0.047	≈ 1.257	≈ 0.015
0.06	<div> <div>49 2</div> <div>50 0, 3</div> <div>51 </div> <div>52 </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	≈ 0.074	≈ 1.964	≈ 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	≈ 0.104	≈ 2.772	≈ 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	≈ 0.125	≈ 3.343	≈ 0.036

I_{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 τ_{net} to α does not display direct variation is that a lack of angular acceleration may occur when torque is not great enough to overcome friction.