FYS3150 Project 2

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(Dated: September 22, 2021)

https://github.com/carlfre/FYS3150-Project-2

PROBLEM 1

Firstly, we want to show that given $\hat{x} \equiv x/L$ and $\lambda = \frac{FL^2}{\gamma}$, this equation

$$\gamma \frac{d^2u(x)}{dx^2} = -Fu(x),$$

can be written as

$$\frac{d^2u(\hat{x})}{d\hat{x}^2} = -\lambda u(\hat{x}) \tag{1}$$

Let us start by replacing x with $\hat{x}$. Since $\frac{d}{dx} = \frac{d\hat{x}}{dx}\frac{d}{d\ \hat{x}} = \frac{1}{L}\frac{d}{d\hat{x}}$, we get

$$\gamma \frac{1}{L^2}\frac{d^2u(\hat{x})}{d\hat{x}^2} = -Fu(x)$$

If we now insert $F = \frac{\lambda\gamma}{L^2}$, we see that our final expression becomes

$$\begin{aligned}\gamma \frac{1}{L^2}\frac{d^2u(\hat{x})}{d\hat{x}^2} &= -\frac{\lambda\gamma}{L^2}u(x) \\ \frac{d^2u(\hat{x})}{d\hat{x}^2} &= -\lambda u(\hat{x}),\end{aligned}$$

which is the same as (**??**), as we wanted to show.