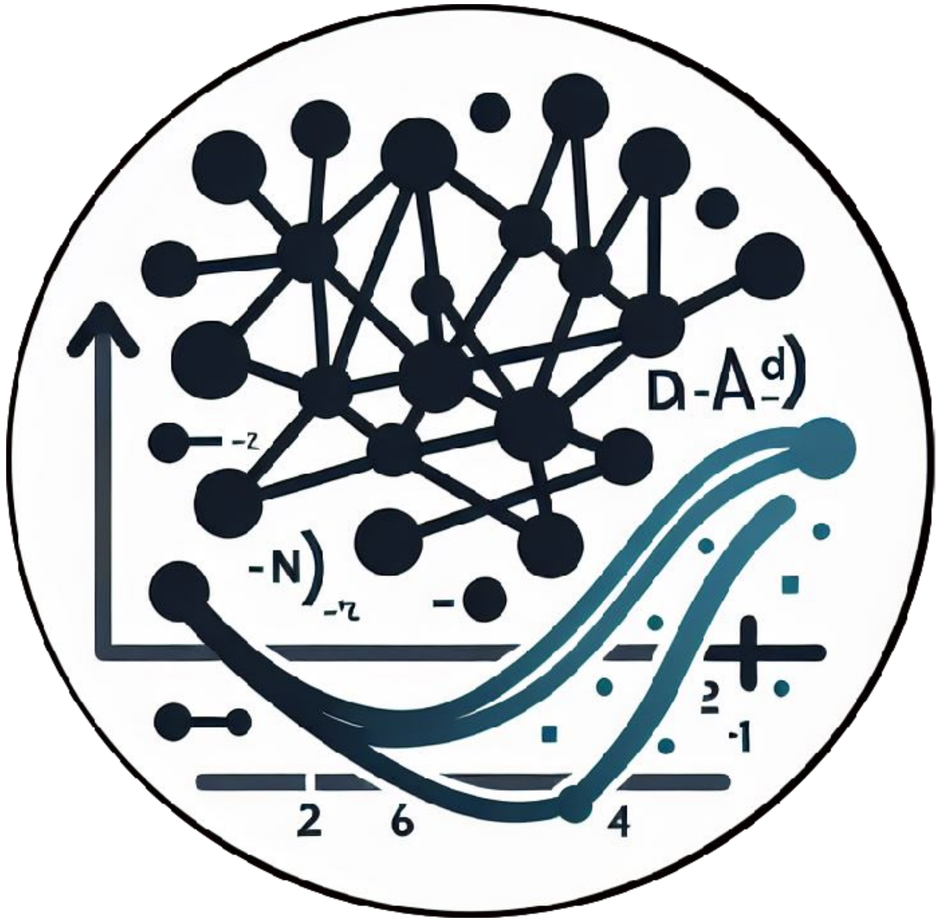
Inverse PINNs



Deep Learning for Engineers
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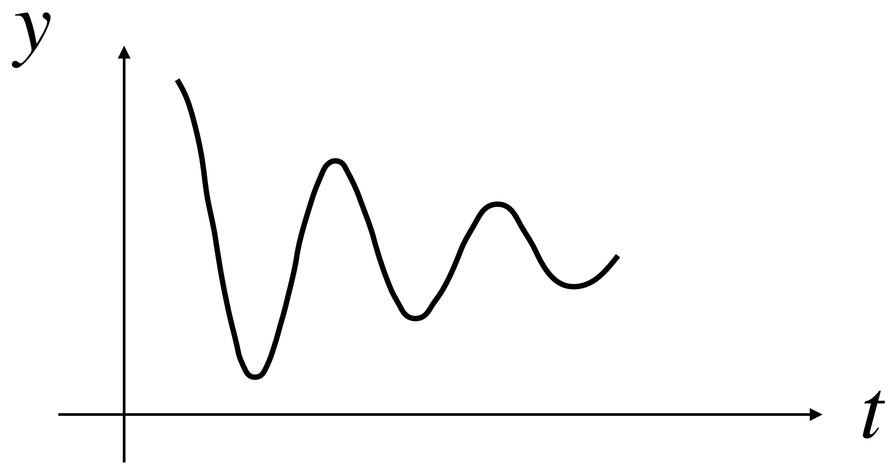
https://benmoseley.blog/my-research/so-what-is-a-physics-informed-neural-network/

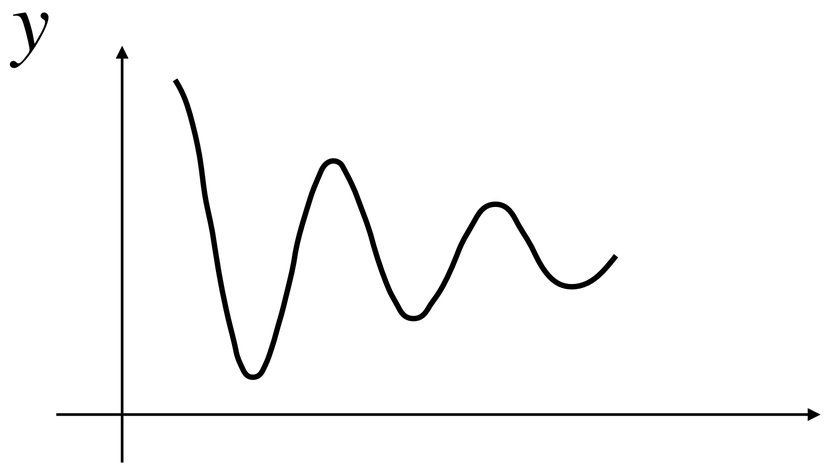
Forward and Inverse Problems

$$m\frac{\partial^2 y}{\partial t^2} + \mu\frac{\partial y}{\partial t} + k\hat{y}$$

m, μ, k

forward





inverse

m, μ, k

Harmonic Oscillator - inverse problem

$$L = \frac{1}{m}\sum_{i=1}^{m}(\hat{y}_i - y_i)^2 + \gamma\frac{1}{n}\sum_{j=1}^{n}\left(m\frac{\partial^2\hat{y}}{\partial t^2} + \mu\frac{\partial\hat{y}}{\partial t} + k\hat{y}\right)_j^2$$

Harmonic Oscillator - inverse problem

$$L = \frac{1}{m}\sum_{i=1}^{m}(\hat{y}_i - y_i)^2 + \gamma\frac{1}{n}\sum_{j=1}^{n}\left(m\frac{\partial^2\hat{y}}{\partial t^2} + \mu\frac{\partial\hat{y}}{\partial t} + k\hat{y}\right)_j^2$$

learn these

```
torch.optim.Adam(model.parameters(), lr=1e-3)
```

```
torch.optim.Adam(model.parameters(), lr=1e-3)
```

```
params = torch.nn.Parameter(torch.zeros(3, requires_grad=True))

torch.optim.Adam(list(model.parameters()) + [params], lr=1e-3)
```

https://github.com/benmoseley/harmonic-oscillator-pinn-workshop

Demo

Challenges with PINNs

selecting weights appropriately

ill conditioning