Exercise 3: DCM for EEG

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Group D: Clara Kümpel, Damola Agbelese, Yitong Li

* 1. **Dynamic equations**

With

derive:

According to *Leibniz’ rule:*

Again, plug term into *Leibniz’ rule:*

*Q.E.D.*

* 1. **Coupled harmonic oscillator**

1. Convert the 2nd order ODE of harmonic oscillator (HO) to a 1st order system.

We have

Let

Then we get a equation set

i.e.,

Q.E.D.

1. Coupled dynamic system: HO is driven by a second HO , i.e.,

Similarly, let:

Keeping notation in (a), we get:

i.e.,

Where:

1. Reconsider equation

Assume:

dynamics of a different population (also follows Eq. )

Transform Eq. to 1st order linear equation system by linearizing

Around , with Taylor expansion, we have:

Then:

Eq. becomes:

Meanwhile:

Let

* 1. **Inference on NN structure**