1. Review 2x2 analytic solution

LTI Consumer (External resource) (0.0 / 1.0 points)

2x2 system

As a warm up, let's revisit the following 2×2 system which describes the flow of medicine between two tanks. Recall that this was modeled using the following system of ODEs:

$$\frac{dh_1}{dt} = a(h_2 - h_1),$$

$$\frac{dh_2}{dt} = a(h_1 - h_2).$$

We then recast this system in matrix form as

$$\dot{\mathbf{x}} = \begin{bmatrix} -a & a \\ a & -a \end{bmatrix} \mathbf{x},$$

where $\mathbf{x} = \begin{bmatrix} h_1 \\ h_2 \end{bmatrix}$. Let's set $a = 1$, and use the initial conditions $\mathbf{x}(0) = \begin{bmatrix} 0 \\ 1 \end{bmatrix}$.

We know that the solution can be written in the form

$$\mathbf{x}(t) = c_1 e^{\lambda_1 t} \mathbf{v}_1 + c_2 e^{\lambda_2 t} \mathbf{v}_2.$$

In a previous exercise, we found the c_i, λ_i and v_i by hand. This is much easier to do with MATLAB.

Use the template below to construct the analytic solution to the above system of equations.

Your Script

Save Reset MATLAB Documentation (https://www.mathworks.com/help/)

```
% Input the 2x2 matrix describing your linear system as a variable A
A = [-1,1;1,-1];
% Input your initial conditions as a column vector x0
x0 = [0;1];
% Use eig(A) to find the eigenvalues and eigenvectors of A.
% Then define the eigenvectors as column vectors v1 and v2, and the eigenvalues a
% so that A*v1 = lambda1*v1, etc.
[V,D] = eig(A);
v1 = V(:,1);
v2 = V(:,2);
lambda1 = D(1,1);
lambda2 = D(2,2);
% Calculate the column vector c = [c1;c2] from the initial conditions using inv(V
c = inv(V)*x0;
c1 = c(1,1); c2 = c(2,1);

```

▶ Run Script ? ()

Previous Assessment: Correct

Submit ? ()

- ✔ **Value of c**
- ✔ **Inv used**
- ✔ **eig used**
- ✔ **value of v1**
- ✔ **value of v2**
- ✔ **value of lambda1**
- ✔ **value of lambda2**

Output

```
Code ran without output
```

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