

Solution of three-tank hydraulic flow

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See comments in the SimpleDESystem notebook for some information on typesetting and syntax.

```
In[*]:= A = {{-3, 1, 1}, {1, -3, 1}, {1, 1, -3}}
```

```
Out[*]=
```

$$\begin{pmatrix} -3 & 1 & 1 \\ 1 & -3 & 1 \\ 1 & 1 & -3 \end{pmatrix}$$

```
In[*]:= u0 = {3, 7, 8}
```

```
Out[*]=
```

$$\{3, 7, 8\}$$

```
In[*]:= Λ = DiagonalMatrix[Eigenvalues[A]]
```

```
Out[*]=
```

$$\begin{pmatrix} -4 & 0 & 0 \\ 0 & -4 & 0 \\ 0 & 0 & -1 \end{pmatrix}$$

```
In[*]:= V = Transpose[Eigenvectors[A]]
```

```
Out[*]=
```

$$\begin{pmatrix} -1 & -1 & 1 \\ 0 & 1 & 1 \\ 1 & 0 & 1 \end{pmatrix}$$

```
In[*]:= c = LinearSolve[V, u0]
```

```
Out[*]=
```

$$\{2, 1, 6\}$$

```
In[*]:= decoupledSoln[t_] = MatrixExp[Λ t].c
```

```
Out[*]=
```

$$\{2 e^{-4 t}, e^{-4 t}, 6 e^{-t}\}$$

```
In[*]:= uSoln[t_] = V . decoupledSoln[t]
```

```
Out[*]=
```

$$\{6 e^{-t} - 3 e^{-4 t}, e^{-4 t} + 6 e^{-t}, 2 e^{-4 t} + 6 e^{-t}\}$$