Homework 1
Numerical Matrix Analysis
Math 543
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$$
\begin{array}{lccr}
\text{Spring 1, } k_{12},\ l_{12} & \text{Spring 2, } k_{23},\ l_{23} & \text{Spring 3, } k_{34},\ l_{34} & (1)\\
m_1 - - - - - - - - - - - \quad m_2 & - - - - - - - - - - \quad m_3 & - - - - - - - - m_4 & (2)\\
f_1 => \qquad <= f_1 \quad f_2 => & <= f_2 \quad f_3 => & <= f_3 & (3)
\end{array}
$$

$$\text{Let } f_1 = k_{12}(-x_1 + x_2 - l_{12}) \tag{4}$$
$$\text{Let } f_2 = k_{23}(-x_2 + x_3 - l_{23}) \tag{5}$$
$$\text{Let } f_3 = k_{34}(-x_3 + x_4 - l_{34}) \tag{6}$$

$$F_1 = -k_{12}x_1 + k_{12}x_2 - k_{12}l_{12} \tag{7}$$
$$F_2 = k_{12}x_1 + (-k_{12} - k_{23})x_2 + k_{23}x_3 + k_{12}l_{12} - k_{23}l_{23} \tag{8}$$
$$F_3 = k_{23}x_2 + (-k_{23} - k_{34})x_3 + k_{34}x_4 + k_{23}l_{23} - k_{34}l_{34} \tag{9}$$
$$F_4 = k_{34}x_3 - k_{34}x_4 + k_{34}l_{34} \tag{10}$$

$$
\begin{pmatrix} F_1 \\ F_2 \\ F_3 \\ F_4 \end{pmatrix} = \begin{pmatrix} -k_{12} & k_{12} & 0 & 0 \\ k_{12} & -k_{12} - k_{23} & k_{23} & 0 \\ 0 & k_{23} & -k_{23} - k_{34} & k_{34} \\ 0 & 0 & k_{34} & -k_{34} \end{pmatrix} \begin{pmatrix} x_1 \\ x_2 \\ x_3 \\ x_4 \end{pmatrix} + \begin{pmatrix} -k_{12}l_{12} \\ k_{12}l_{12} - k_{23}l_{23} \\ k_{23}l_{23} - k_{34}l_{34} \\ k_{34}l_{34} \end{pmatrix}
$$

$\mathbf{F}$ is Newtons and $\mathbf{x}$ is meters, so $\mathbf{K}$ is, or the dimensions of the entries of $\mathbf{K}$ are of $\frac{\text{Newtons}}{\text{Meters}}$.

The det($\mathbf{K}$) is of $\frac{\text{Newtons}}{\text{Meters}}^4$. I know this because the determinant would be a product of the diagonal, which is made of 4 entries.

K' is 10^-1 of the meters of $\mathbf{K}$,10^-3 of the grams of $\mathbf{K}$, and the same as the seconds of $\mathbf{K}$. The dimensions of the The det($\mathbf{K}$) is the same as the det(**K'**) because the dimensions of the matrix doesn't change when multiplied by scalar multiples.