Matlab Homework 6c

The same requirements as for homework 3c apply.

1. Consider a power line between two poles. It sags down under its own weight. The amounts of sag s at 6 points distributed along the first half of the power line satisfy the (approximate) equations

$$\begin{aligned} s_1 &= 0 && (1)\\ s_1 - 2s_2 + s_3 &= 0.01 && (2)\\ s_2 - 2s_3 + s_4 &= 0.01 && (3)\\ s_3 - 2s_4 + s_5 &= 0.01 && (4)\\ s_4 - 2s_5 + s_6 &= 0.01 && (5)\\ s_5 - s_6 &= 0 && (6) \end{aligned}$$

   Write this system of 6 equations in the 6 unknown sag values in matrix-vector form. Check whether it has a meaningful solution; use `disp` to discuss this. In particular, estimate the relative error in the solution that will caused by the fact that floating point numbers in Matlab are only stored to about 16 significant digits. If you conclude that a reasonably or highly accurate solution will be found, find it and plot the sag against the horizontal position of the points. (The points are located at 6 equally spaced x-positions from 0 to 50% of the distance between the poles.) Plot the points as black circles connected by solid lines. Provide appropriate axes labels and title, and extend the horizontal axes for no more than the 50%. For horizontal axis label, use "Position, percent". Put the x-axis at the origin. Make sure it does not extend longer than 50%. Does it look roughly like half a sagging power line?

2. Repeat when the first equation $s_1 = 0$ is replaced by $s_1 - s_2 = 0$. Do not create a new matrix and vector from scratch. Keep the ones you have, but just change the elements that are different. If you find that the system has no meaningful solution, say so, but try to solve anyway and comment on what you get using `disp`. If you get some numbers but they are no good, explain why.

3. Given the matrices

$$A = \begin{pmatrix} -2 & 2 \\ 0 & 1 \\ 14 & 2 \\ 6 & 8 \end{pmatrix} \qquad B = \begin{pmatrix} 3 & 4 \\ 2 & 1 \\ 14 & 16 \\ 1 & 25 \end{pmatrix}$$

   find, if it exists (else note that it does not using `disp`),

   - $-5A + 3B$;
   - A^{T};
   - AB, BA, $A^{\mathrm{T}}B$, and BA^{T} (note that the latter two are not equal);
   - the non-matrix (elementwise) products AB, BA, $A^{\mathrm{T}}B$, and BA^{T};