

Matrix operation 0315

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(2-variable function)

The potential energy stored in a spring is $kx^2/2$, where k is the spring constant and x is the compression in the spring. The force required to compress the spring is kx . The following table gives the data for five springs:

	Spring				
	1	2	3	4	5
Force (N)	11	7	8	10	9
Spring constant k (N/m)	1000	600	900	1300	700

Use MATLAB to find (a) the compression x in each spring and (b) the potential energy stored in each spring.

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Exer 4.4, 4.5, 4.8

Exercise 1 :

Using estimates of rainfall, evaporation, and water consumption, the town engineer developed the following model of the water volume in the reservoir as a function of time

$$V(t) = 10^9 + 10^8(1 - e^{-t/100}) - rt$$

where V is the water volume in liters, t is time in days, and r is the town's consumption rate in liters per day. Write two user-defined functions. The first function should define the function $V(t)$ for use with the `fzero` function. The second function should use `fzero` to compute how long it will take for the water volume to decrease to x percent of its initial value of 10^9 L. The inputs to the second function should be x and r . Test your functions for the case where $x = 50$ percent and $r = 10^7$ L/day.

Exercise 2 :

The volume V and paper surface area A of a conical paper cup are given by

$$V = \frac{1}{3}\pi r^2 h \quad A = \pi r \sqrt{r^2 + h^2}$$

where r is the radius of the base of the cone and h is the height of the cone.

- By eliminating h , obtain the expression for A as a function of r and V .
- Create a user-defined function that accepts R as the only argument and computes A for a given value of V . Declare V to be global within the function.
- For $V = 10 \text{ in.}^3$, use the function with the `fminbnd` function to compute the value of r that minimizes the area A . What is the corresponding value of the height h ? Investigate the sensitivity of the solution by plotting V versus r . How much can R vary about its optimal value before the area increases 10 percent above its minimum value?