Product requirement document

Software title: Matrix Calculator

Many engineering problems involve a large number of unknowns and a large number of equations to be solved simultaneously. These can number in the hundreds or even the thousands in practice. Matrices are a convenient way of representing and manipulating such problems. Matrix can solve many problems of linear calculation. Using this software can quickly and conveniently calculate matrix and solve engineering practical problems. For example, if there are 100 elements and there is a relationship between each two elements, then a matrix of order 100 can be expressed, which is very troublesome for other methods to implement.

This software can realize the creation, input, output, transformation and transposition of matrix and the calculation of properties, such as inverse of matrix, determinant of a matrix, rank of matrix and so on.

The transpose of the m × n matrix A is an n × m matrix denoted by A^T and obtained by interchanging the rows and columns of A.

If A is a square matrix, then its inverse matrix is denoted by A^{-1} and is defined by the property that

$$\boldsymbol{A^{-1}A = AA^{-1} = I}$$

The determinant of one n × n matrix of is equal to the sum of the product of the elements of any row (or column) and the corresponding algebraic cofactor

$$\boldsymbol{det(A)=a_{i1}A_{i1}+\ldots\ldots+a_{in}A_{in}=\sum_{k=0}^{n} a_{ik}(-1)^{i+k}M_{ik}}$$

The concept of rank of a matrix is very useful when finding the solution of a set of linear equations. First of all, let $A \in R^{m\times n}$ be a matrix denoted as follows.

$$A = \begin{pmatrix} \uparrow & \uparrow & & \uparrow \\ v_1 & v_2 & \cdots & v_n \\ \downarrow & \downarrow & & \downarrow \end{pmatrix},$$

where v_i , i = 1, ..., n, denotes the i-th column of A. Then the rank of A, denoted by rank A or by R(A), is defined as the number of linearly independent vectors in the set v_1, v_2, . . . , v_n.