

§3. MA TRẬN NGHỊCH ĐẢO

Trong bài này, bạn sẽ học

- Khái niệm ma trận khả nghịch và ma trận đảo của một ma trận vuông;
- Các tính chất ma trận khả nghịch;
- Điều kiện cần và đủ để một ma trận vuông khả nghịch;
- Hai cách cơ bản tìm ma trận đảo của một ma trận khả nghịch;
- Ứng dụng ma trận đảo để giải phương trình ma trận và hệ phương trình tuyến tính.

3.1. Định nghĩa

Ma trận vuông $A = [a_{ij}]_{n \times n}$ gọi là *khả nghịch* nếu có ma trận $B = [b_{ij}]_{n \times n}$ sao cho

$$AB = I_n = BA.$$

Khi đó B gọi là *ma trận nghịch đảo* hay *ma trận đảo* của A , ký hiệu là A^{-1} .

Vậy A khả nghịch khi và chỉ khi tồn tại A^{-1} và $AA^{-1} = I_n = A^{-1}A$.

Ví dụ 1 Với $A = \begin{pmatrix} 1 & 2 \\ 2 & 3 \end{pmatrix}$, $B = \begin{pmatrix} -3 & 2 \\ 2 & -1 \end{pmatrix}$. Ta có

$$AB = \begin{pmatrix} 1 & 2 \\ 2 & 3 \end{pmatrix} \begin{pmatrix} -3 & 2 \\ 2 & -1 \end{pmatrix} = \begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix} = \begin{pmatrix} -3 & 2 \\ 2 & -1 \end{pmatrix} \begin{pmatrix} 1 & 2 \\ 2 & 3 \end{pmatrix} = BA.$$

Vậy A khả nghịch và $A^{-1} = \begin{pmatrix} -3 & 2 \\ 2 & -1 \end{pmatrix} = B$; B khả nghịch và $B^{-1} = \begin{pmatrix} 1 & 2 \\ 2 & 3 \end{pmatrix} = A$.

Lưu ý Với $A = [a_{ij}]_{n \times n}$, $B = [b_{ij}]_{n \times n}$: $AB = I_n$ khi và chỉ khi $BA = I_n$.

3.2. Tính chất

- Ma trận đảo của ma trận A (nếu có) thì duy nhất và $(A^{-1})^{-1} = A$
- Nếu A khả nghịch thì A^T cũng khả nghịch và $(A^T)^{-1} = (A^{-1})^T$
- Nếu $A = [a_{ij}]_{n \times n}$, $B = [b_{ij}]_{n \times n}$, $C = [c_{ij}]_{n \times n}$ khả nghịch thì tích AB , ABC cũng khả nghịch và $(AB)^{-1} = B^{-1}A^{-1}$; $(ABC)^{-1} = C^{-1}B^{-1}A^{-1}$

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Zhe Xu

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