

MA 265 Lecture 22

Section 4.7 Homogeneous Systems

Consider the homogeneous system

$$A\mathbf{x} = \mathbf{0},$$

where A is $m \times n$, The set of all solutions

Example 1. Find a basis of the solution space of the linear system

$$\begin{bmatrix} 1 & 1 & 4 & 1 & 2 \\ 0 & 1 & 2 & 1 & 1 \\ 0 & 0 & 0 & 1 & 2 \\ 1 & -1 & 0 & 0 & 2 \\ 2 & 1 & 6 & 0 & 1 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \\ x_3 \\ x_4 \\ x_5 \end{bmatrix} = \begin{bmatrix} 0 \\ 0 \\ 0 \\ 0 \\ 0 \end{bmatrix}$$

Remark For the homogeneous system $A\mathbf{x} = \mathbf{0}$, if the reduced row echelon form of $[A \mid \mathbf{0}]$ has r nonzero rows, then

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Relationship between Homogeneous and Nonhomogeneous Systems

For nonhomogeneous system $A\mathbf{x} = \mathbf{b}$, the set of solutions

Example 2. Consider the linear system

$$\begin{bmatrix} 1 & 2 & -3 \\ 2 & 4 & -6 \\ 3 & 6 & -9 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix} = \begin{bmatrix} 2 \\ 4 \\ 6 \end{bmatrix}$$