AE 695 – State Space Methods

Quiz 1, Thursday, 31/08/06, 4:15pm-5pm, Open Notes, 10 marks

1. Which of the following sets form a field? Explain briefly. (4)

   (a) Set of $n \times n$ matrices under matrix multiplication and addition.

   (b) Set of $n \times n$ invertible matrices under matrix multiplication and addition.

   (c) The set of irrational numbers.

   (d) The set $\{0\}$.

2. Which of the following sets are examples of vector spaces over $\mathbb{R}$? Explain briefly. (3)

   (a) The set $\{A \in \mathbb{R}^{n\times n} : A + A^{\mathrm{T}} = 0\}$ of skew symmetric matrices.

   (b) The set $\{X \in \mathbb{R}^{n\times n} : A^{\mathrm{T}}X + XA = 0\}$ for a fixed matrix $A \in \mathbb{R}^{n\times n}$.

   (c) The set $\{X \in \mathbb{R}^{n\times n} : A^{\mathrm{T}}X + XA = Q\}$ for fixed matrices $A, Q \in \mathbb{R}^{n\times n}$.

3. Let $v \in \mathbb{R}^3$ be a fixed vector. Define an operator $L : \mathbb{R}^3 \times \mathbb{R}^3$ by $L(x) = v \times x$, where "$\times$" denotes the familiar cross product operation on vectors in ordinary 3D space. Write down the matrix representation of L in the standard basis for $\mathbb{R}^3$. (3)

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