

DEPARTMENT OF MATHEMATICS AND STATISTICS
MISSISSIPPI STATE UNIVERSITY

COLLOQUIUM

An Introduction to Quaternions and Matrices of Quaternions

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Allen 14

Abstract. Quaternions were first introduced by Irish mathematician Sir William Rowan Hamilton in 1843. A quaternion x is a number that has a form of

$$x = x_0 + x_1i + x_2j + x_3k, \text{ where } i^2 = j^2 = k^2 = -1, \text{ and } ij = -ji = k,$$

with x_0, x_1, x_2, x_3 real numbers. Quaternions are a non-commutative extension of the complex numbers. In recent years, applications of quaternions and matrices of quaternions are getting more and more important and extensive in quantum mechanics, quantum chemistry, control theory, engineering, robotics, and aerospace etc. By means of complex representations of quaternions and quaternion matrices and companion vector, a new algebra structure of quaternions is given. By introducing definitions of determinant and rank of a quaternion matrix, we derive a technique of finding an inverse matrix of a quaternion invertible matrix, and give a Cramer rule for quaternionic linear equations. We also study the problems of eigenvalues and eigenvectors of quaternion matrices, and give a technique of computing the eigenvalues and eigenvectors of the quaternion matrices in quaternionic quantum mechanics.

There will be a reception for Dr. Jiang in Allen 467 at 1:30.