1014-00-254   **Yan Wu*** (`yan@georgiasouthern.edu`), Department of Mathematical Sciences, Georgia Southern University, P.O. Box 8093, Statesboro, GA 30460-8093. *Construct Integral Matrices with Integral Inverse and Applications to Coding.*

The objective of this work lies in two-fold: (i) study the structure of a special class of integral matrices whose inverse are also integral matrices; (ii) develop a systematic approach for the construction of such integral matrices. The above specified integral matrices form a subspace of the matrix space M over the integer field Z. A necessary and sufficient condition for an integral matrix to have an integral inverse is that the absolute value of the determinant of the matrix equals one. The main result is stated in a theorem followed by a proof. In order to construct an integral matrix with integral inverse, we allow up to two free parameters in the matrix. The parameters are determined so that the determinant of the new integral matrix is either one or negative one. The required values for the parameters turn out to be solutions of some linear or nonlinear Diophantine equations. The main algorithm consists of the Euclidean algorithm for the linear Diophantine equation and a special algorithm for the nonlinear Diophantine equation. Those algorithms are programmed in MATLAB. They are capable of working with matrices of higher dimensions. The result of this work has applications in areas such as numerical linear algebra and secure communication in signal processing. (Received August 31, 2005)