1116-VF-387 **Wing Hong Tony Wong*** (wong@kutztown.edu), Mathematics Department, Kutztown University of Pennsylvania, 15200 Kutztown Road, Kutztown, PA 19530. *Diagonal forms and zero-sum (mod 2) bipartite Ramsey numbers.*

Let G be a subgraph of a complete bipartite graph $K_{n,n}$. Let $\mathbf{h}$ be the characteristic vector of G, i.e. $\mathbf{h}$ is a column vector of length n^2 indexed by the edges of $K_{n,n}$, with 1 if the edge is in G and 0 otherwise. Let $N(G)$ be the matrix with $2(n!)^2$ columns, each column representing an image of $\mathbf{h}$ under the action of the graph automorphism group on $K_{n,n}$.

In this paper, a general formula for a diagonal form of $N(G)$ is found for every G, and the question as to whether the row space of $N(G)$ over $\mathbb{Z}_p$ contains the vector of all 1's is settled. This implies a new proof of Caro and Yuster's results on zero-sum (mod 2) bipartite Ramsey numbers. Zero-sum Ramsey problems were studied by Bialostocki and Dierker as well as Alon and Caro.

Apart from applications in zero-sum Ramsey problems, these results on the diagonal forms of $N(G)$ also provide necessary and sufficient conditions for the existence of a signed bipartite graph design. (Received August 30, 2015)