Let $H$ be a $t$-uniform hypergraph on $k$ vertices, with $a_i \geq 0$ denoting the multiplicity of the $i$-th edge, $1 \leq i \leq \binom{k}{t}$. Let $h = (a_1, \ldots, a_{\binom{k}{t}})^\top$, and $N_t(H)$ the matrix whose columns are the images of $h$ under the symmetric group $S_k$. We determine a diagonal form (Smith normal form) of $N_t(H)$ for a very general class of $H$.

Now, assume $H$ is simple. Let $K_n^{(t)}$ be the complete $t$-uniform hypergraph on $n$ vertices, and $R(H, \mathbb{Z}_p)$ the zero-sum (mod $p$) Ramsey number, which is the minimum $n \in \mathbb{N}$ such that for every coloring $c : E(K_n^{(t)}) \to \mathbb{Z}_p$, there exists a copy $H'$ isomorphic to $H$ inside $K_n^{(t)}$ such that $\sum_{e \in E(H')} c(e) = 0$. Through finding a diagonal form of $N_t(H)$, we reprove a theorem of Y. Caro that gives the value $R(G, \mathbb{Z}_2)$ for any simple graph $G$. Further, we show that for any $t$, $R(H, \mathbb{Z}_2)$ is almost surely $k$ as $k \to \infty$, where $k$ is the number of vertices of $H$.

Similar techniques can also be applied to determine the zero-sum (mod 2) bipartite Ramsey numbers, $B(G, \mathbb{Z}_2)$, introduced by Caro and Yuster. (Received September 24, 2012)