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The intersection spectrum of Skolem sequences and its applications to λ-fold cyclic triple systems

A Skolem sequence of order n is a sequence $S_n = (s_1, s_2, \ldots, s_{2n})$ of $2n$ integers containing each of the symbols $1, 2, \ldots, n$ exactly twice, such that two occurrences of the integer $j \in \{1, 2, \ldots, n\}$ are separated by exactly $j - 1$ symbols. We prove, with few possible exceptions, that there exists two Skolem sequences of order n with $0, 1, 2, \ldots, n-3$ or n pairs in common. Using this result, we determine, with few possible exceptions the fine structure of a cyclic three-fold triple systems, for $v \equiv 1, 7$ $(\mathrm{mod}\ 24)$. We also determine, with few exceptions, the fine structure of a cyclic four-fold triple systems, for $v \equiv 1, 7$ $(\mathrm{mod}\ 24)$. Then, we extend these results to the fine structure of a λ-fold directed triple system and a λ-fold Mendelsohn triple system. We also determine, the number of possible repeated base blocks in a cyclic two-fold triple system, a directed triple system and a Mendelsohn triple system, for $v \equiv 1, 3$ $(\mathrm{mod}\ 6)$.