

## Almost resolvable $k$ -cycle systems

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A  $k$ -cycle system of order  $n$  is a pair  $(X, \mathcal{C})$  where  $\mathcal{C}$  is a collection of edge disjoint  $k$ -cycles which partition the edge set of the complete undirected graph  $K_n$  with  $V(K_n) = X$ . A  $k$ -cycle system  $(X, \mathcal{C})$  is said to be resolvable if the cycles belonging to  $\mathcal{C}$  can be partitioned into parallel classes.

If  $(X, \mathcal{C})$  is a  $k$ -cycle system of order  $n$  and  $k$  does not divide  $n$  then we cannot have a parallel class of  $k$ -cycles. The closest we can come to a parallel class is a collection of  $(n-1)/k$  vertex disjoint  $k$ -cycles; any such collection is called an almost parallel class. The maximum possible number of edge disjoint almost parallel classes in a  $k$ -cycle system of order  $n$  is  $(n-1)/2$  in which case a half parallel class containing  $(n-1)/2k$  vertex disjoint  $k$ -cycles is left over. A  $k$ -cycle system of order  $n$  whose  $k$ -cycles can be partitioned into  $(n-1)/2$  almost parallel classes and a half parallel class is said to be almost resolvable and is denoted by  $k$ -ARCS( $n$ ).

The existence of 3-ARCSs was settled in 1993 by H. Hanani. Moreover, quite recently I. Dejter, C. Lindner, C. Rodger and M. Meszka proved the existence of 4-ARCSs. Complete solutions for  $k=6$  and  $k=10$  as well as a complete solution with one possible exception for  $k=14$  will be presented.