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Triple metamorphosis of twofold triple systems

The concept of a metamorphosis of block designs, due to Lindner, has been dealt with in many papers. Typically, for a subgraph $G'$ of $G$, each block of a $G$-design of order $n$ and index $\lambda$ is modified by deleting the edges of $G \setminus G'$, and then reassembling the totality of deleted edges into $G'$-blocks, so as to form, together with the modified blocks of the original $G$-design, a new $G'$-design of order $n$ and index $\lambda'$.

One such instance is the metamorphosis of a simple twofold triple system of order $n$, TS($n$, 2), into a twofold 4-cycle system of order $n$, 4C($n$, 2). The spectrum for TS($n$, 2) having a metamorphosis into 4C($n$, 2) has previously been shown to be the set $n \equiv 0, 1, 4, 9 \pmod{12}$, $n \geq 9$. Here we extend the concept of metamorphosis to that of a triple metamorphosis of a TS($n$, 2) into a 4C($n$, 2). We show that the necessary conditions for the existence of a triple metamorphosis of a TS($n$, 2) into a 4C($n$, 2) are also sufficient, with one exception ($n = 9$) and one possible exception ($n = 12$). (This is joint work with Curt Lindner and Mariusz Meszka.)