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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 λ 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 λ' . One such instance is the metamorphosis of a simple twofold triple system of order n , $\text{TS}(n, 2)$, into a twofold 4-cycle system of order n , $4\text{C}(n, 2)$. The spectrum for $\text{TS}(n, 2)$ having a metamorphosis into $4\text{C}(n, 2)$ 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 $\text{TS}(n, 2)$ into a $4\text{C}(n, 2)$. We show that the necessary conditions for the existence of a triple metamorphosis of a $\text{TS}(n, 2)$ into a $4\text{C}(n, 2)$ are also sufficient, with one exception ($n = 9$) and one possible exception ($n = 12$). (This is joint work with Curt Lindner and Mariusz Meszka.)