Infinite Families of Non-embeddable Quasi-residual Menon Designs

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Abstract: The notion of residual and derived design of a symmetric design was introduced in a classic paper by R.C. Bose (1939). A quasi-residual (quasi-derived) design is a 2-design which has the parameters of a residual (derived) design. The embedding problem of a quasi-residual design into a symmetric design is an old and natural question. A Menon design of order h^2 is a symmetric $(4h^2, 2h^2 - h, h^2 - h)$-design. Quasi-residual and quasi-derived designs of a Menon design have parameters $2-(2h^2+h, h^2, h^2-h)$ and $2-(2h^2-h, h^2-h, h^2-h-1)$, respectively.

We use regular Hadamard matrices to construct non-embeddable quasi-residual and quasi-derived Menon designs. As applications, the first two new infinite families of non-embeddable quasi-residual and quasi-derived Menon designs are constructed. This is joint work with T.A. Alraqad.