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Dan Archdeacon*, dan.archdeacon@uvm.edu. *Orthogonal Heffter systems, current graphs, and bi-embedding graphs on surfaces.* Preliminary report.

We examine a classical problem in design theory and its relation to the Map Color Theorem (MCT).

A Heffter 3-system is a partition of the integers $1, \dots, 3n$ into n triples (x, y, z) such that either $x+y=z$ or $x+y+z=6n+1$. These are used to construct Steiner Triple Systems (STS). A generalization to Heffter s -systems constructs s -cycle systems. We introduce the concept of orthogonal Heffter s - and t -systems, relate the concept to current graphs, and then to their derived surface embeddings. There is a beautiful interaction between design-theoretic properties of Heffter systems and the resulting surface embeddings.

As an example of a far-reaching theory, we study when there is an embedding of the complete graph into an orientable surface such that the faces can be 2-colored with one class all triangles and the other class all t -cycles. This generalizes the concept of bi-embedding STS's with a cyclic symmetry that is in turn related to the MCT. (Received September 21, 2011)