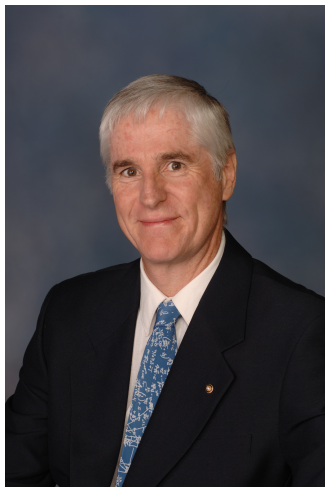
Preface

Note. The text book, *Design Theory* Second Edition, Discrete Mathematics and Its Applications Series, by Curt C. Linder and Chris A. Rodger, CRC Press (2008), is written for use in Auburn University's undergraduate/graduate class "Combinatorial Designs" (MATH 5770/6770). The 2021-22 Auburn Bulletin (accessed 5/8/2022) description of Combinatorial Designs is:

> **Combinatorial Designs (MATH 5770/6770).**
>
> Latin squares, mutually orthogonal latin squares, orthogonal and perpendicular arrays, Steiner triple systems, block designs, difference sets and finite geometries.

Note. Both authors of the text book, Curt C. Lindner (July 21, 1938-February 21, 2023) and Chris A. Rodger, are emeritis professors from Auburn University's Department of Mathematics and Statistics (the source of the following images).

Curt Lindner



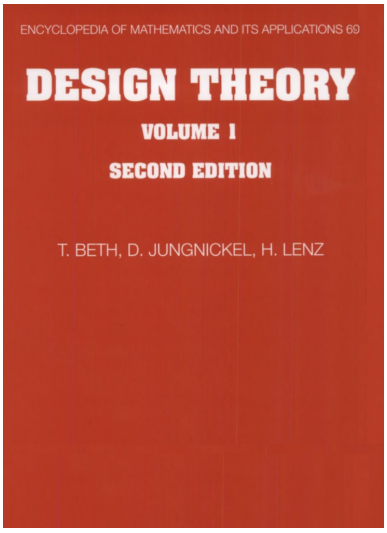
Chris Rodger

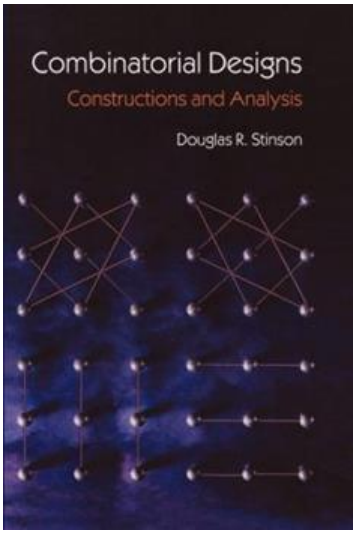
Note. The book emphasizes construction techniques. The designs of particular interest include Steiner triple systems, latin squares, finite projective planes, and finite affine planes. Additional structure is imposed such as resolvability, embeddings, and orthogonality. The more complicated Steiner quadruple systems are considered in Chapter 9. The ETSU Sherrod Library has a copy of this available online (you need your ETSU username and password to access it).

Note. Lindner and Rodger's book is designed(!) for an undergraduate/graduate course. The ETSU Sherrod Library has copies available online (you need your ETSU username and password to view it). For a graduate-only level course on design theory, text book options seem limited. This is likely due to the newness and the rapid growth of this area of discrete mathematics. Two options are:

1. Thomas Beth, Dieter Jungnickel, Hanfried Lenz, *Design Theory*, 2nd edition, Volume I (Encyclopedia of Mathematics and its Applications, Series Number 69) Cambridge University Press (1999). This is a largely theorem/proof presentation of lots of material (over 1100 pages), but also includes examples and a few exercises. The ETSU Sherrod Library has a copy of this (QA166.25.B47 1999 v.69). There is also a Volume 2 (Encyclopedia of Mathematics and its Applications, Series Number 78) 2nd Edition that is over 500 pages long. The ETSU Sherrod Library has a copy (QA166.25.B47 1999 v.78) and it is available online through the ETSU library. I am preparing class notes based on this source which will be posted online on my Graduate Design Theory Class Notes webpage.

2. Douglas Stinson, *Combinatorial Designs: Constructions and Analysis*, Springer-Verlag (2004). The author describes this book as for a course at the "senior undergraduate or beginning graduate level." It seems that this source is more advanced than the Lindner and Rodger book and might be useful for a graduate-only course (especially for those with no background in design theory); it could also be supplemented with some of the sources given below.





Note. The following references are are not textbooks, but are research monographs or collections of research papers. These are probably best used for supplemental topics to a mainstream graduate-only design theory class.

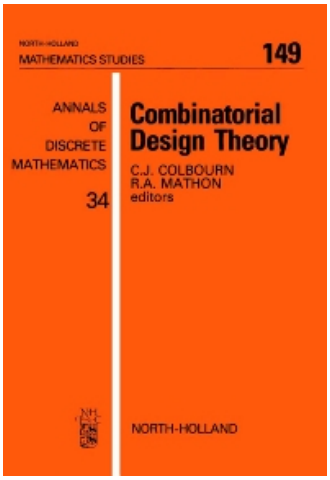
1. Charles J. Colbourn and Rudolph Mathon (Editors), *Combinatorial Design Theory*, North-Holland Mathematics Studies 149, Annals of Discrete Mathematics (34), Elsevier Science Publishers (1987). This is a collection of papers and not so much a text book. It lays out the state of combinatorial design the as of the mid-1980s (following the "explosive growth" of that area in the preceding

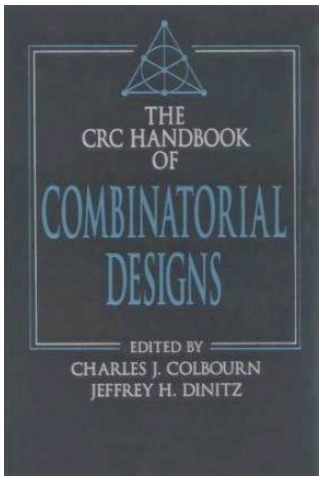
years) in this volume dedicated to Alex Rosa. It has a sibling volume, *Algorithms in Combinatorial Design Theory* edited by C. J. Colbourn and M. J. Colbourn (North-Holland Mathematics Studies 114, Annals of Discrete Mathematics (26), Elsevier Science Publishers, 1985). These two sources are listed in the ETSU Sherrod Library catalog, but are not available except through interlibrary loan.

2. Charles Colbourn and Alex Rosa, *Triple Systems*, Oxford Mathematical Monographs, Oxford University Press (1999). This is on a topic related to design theory, and not design theory itself. The authors describe it as "intended to be read primarily by those with a basic knowledge of combinatorial design. . . . We expect the book to be of primary value to researchers, graduate students, and those in allied fields needing a guide to this large and varied topic." The topic of triple systems is part of your humble instructor's background, and a dozen of my papers appear in the bibliography of this source (humility aside!). The ETSU Sherrod Library has a copy of this (QA166.3.C65 1999).

3. Charles J. Colbourn and Jeffrey H. Dinitz (editors), *CRC Handbook of Combinatorial Designs*, 2nd Edition, CRC Press (2007). This is also a collection of papers and runs about 1000 pages. It takes the state of design theory into the 21st century. The ETSU Sherrod Library has a copy of the 1st edition (QA166.25.C73 1996).

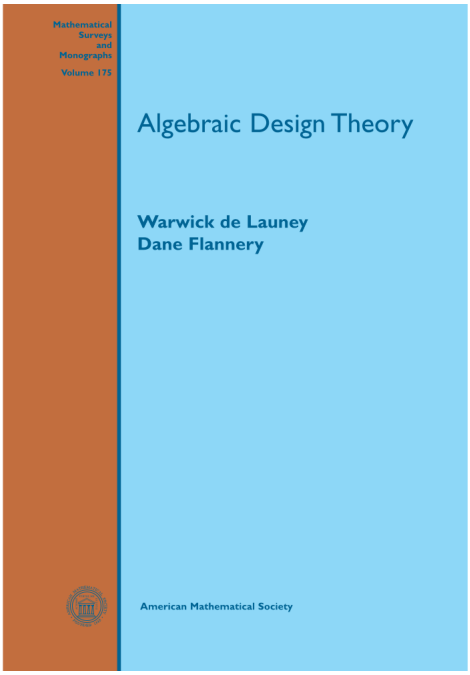
You may be able to view the table of contents and some of the pages on Amazon.com and Google Books (accessed 5/17/2022).





Note. As a relatively new branch of mathematics, it was not until 1993 that a journal devoted entirely to design theory appeared. The *Journal of Combinatorial Designs* started with editors-in-chief of Charles Colbourn, Alexander Rosa, and Douglas Stinson. The website for this journal is maintained on the Wiley Online Library webpage. The *Journal of Graph Theory* (started in 1977) is also on the Wiley Online Library webpage (accessed 5/21/2022).

Note. One final reference worthy of mention is Warwick de Launey and Dane Flannery's *Algebraic Design Theory*, Mathematical Surveys and Monographs Volume 175, American Mathematical Society (2011). This work is mean to stimulate interest in algebraic questions posed by design theory; it "takes an unusually abstract approach." It's use is probably best as a supplement to a graduate-only design theory class for students with strong backgrounds in modern algebra, or as a supplement to a graduate-level modern algebra class for giving students an introduction to some design theoretic ideas.



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