*World Transactions on Engineering and Technology Education*
*Vol.5, No.3, 2006*


# Teaching two-way ribbed slab analysis and design using the *MathCAD* program

**Mohammed S. Al-Ansari**

University of Qatar
Doha, Qatar

ABSTRACT: In this article, the author presents a parallel approach to the traditional teaching method of two-way ribbed slabs. In this approach, the emphasis has been shifted to the use of the *MathCAD* program in developing a better understanding of the analysis and design of two-way ribbed slabs. *MathCAD* possesses efficient computation and presentation capabilities. It holds strong potential as a teaching tool, as well as a learning aid for education and training. By using the presentation and programming features available in *MathCAD*, interactive teaching and learning devices in the analysis and design of two-way ribbed slabs have been produced. A case study is used in order to demonstrate the application of the *MathCAD* program and to demonstrate its impact on teaching the analysis and design of two-way ribbed slabs.

## INTRODUCTION

Engineering students have used computers for many years in order to assist them in performing complicated analysis, design and drafting tasks. Unfortunately, the use of computers has also been greatly limited to routine tasks. The author believes that the emphasis must be shifted to enabling students to better understand the engineering problem for which the computer is being used. The utilisation of the power of computers to promote a better understanding of structural analysis and design should be essential in teaching structural engineering students.

*MathCAD* is an efficient learning environment for technical topics such as reinforced concrete design [1]. Its computational and presentation capabilities not only lend themselves to the solution of mathematically-based problems, but also to the effective communication of both the problem and solution. *MathCAD* enables information to be clearly presented, allowing for user interaction in a logical and uncomplicated manner. It contains powerful presentation capabilities, which include the use of charts, graphic objects and animation effects. *MathCAD* can also easily import objects from other application programs, such as images and digital photographs. These capabilities offer significant learning enhancements to students of technical subjects.

*MathCAD* makes possible new learning strategies for students and teachers. *What-if* discussions, trend analyses, trial and error analyses, and optimisation are all valuable learning activities that take more time than the traditional technical problem-solving approach permits. Taking advantage of the computational power and speed of *MathCAD*, instructors and students can quickly cycle through problem scenarios, observing trends in the analysis and design behaviours of two-way ribbed slabs. More importantly, *MathCAD* enables students/designers to carry out parametric studies to explore possible design solutions and gain a better understanding of the process through the interactive presentation of information.

*MathCAD* greatly enhances a better understanding of a problem, its constraints and limitations. By using the *MathCAD* program, the student/engineer will have a better understanding of various aspects of the problem. Such aspects have not been readily available in previously developed powerful computer packages that assist students/designers in their structural analysis and design.

The main objective of this article is to demonstrate that the use of *MathCAD* can promote a better understanding of the analysis and design of two-way ribbed slabs. A case study is utilised in order to demonstrate the application of the *MathCAD* program and show its impact on teaching the analysis and design of two-way ribbed slabs.

## OVERVIEW OF REINFORCED CONCRETE DESIGN PHILOSOPHIES

A large number of structures are built of reinforced concrete: bridges, viaducts, buildings, etc. Reinforced concrete is a logical union of two materials: plain concrete, which possess high compressive strength but little tensile strength, and steel bars embedded in the concrete, which can provide the needed strength in tension.

Two philosophies of design have been prevalent. The working stress method, which focuses on conditions at the service load (ie when the structure is being used), was the principal method used from the early 1900s until the 1960s. Today, the strength design method is used, which focuses on conditions at loads greater than service loads when failure may be imminent.

In the strength design method, the service loads are increased sufficiently by factors in order to obtain the load at which