Introduction to Design of Experiments Module (with biomechanics emphasis)

This module is designed to introduce design of experiments (DOE) concepts to students in project /laboratory oriented courses. It consists of this introduction, three lectures (in the form of PDF slide sets), practice problems, and problem solutions. Examples in the lectures have been chosen to emphasize biomedical applications. However the principles are equally applicable to other areas. Click below to access the module components:

**Lecture 1** **Lecture 2** **Lecture 3**

**Practice Problems** **Problem Solutions**

Upon completion of this module students should be able to:

1) set-up, analyze (ANOM, ANOVA), and interpret 2-level full-factorial experimental designs (with or without utilizing commercial software packages).

2) set up and analyze 2-level fractional factorial and 3-level factorial designs, with the aid of a commercial software package.

3) interpret the results of factorial and similar designs (e.g. Placket-Burman, Taguchi L18), when presented in a common format (i.e. ANOM, ANOVA table).

The first lecture explains the underlying structure of a "designed experiment", using 2-level full factorial designs and contrasting this method with the "one-at-a-time" approach that most students have previously learned. Students are taught some basic terminology, shown how to perform an ANalysis Of Means (ANOM), and learn how to build a simple mathematical model from their experimental results.

The second lecture focuses on the use of ANalysis Of VAriance (ANOVA) to judge statistical significance. Two methods for estimating the experimental error (replication and pooling of higher-order-interactions) are described. Students are walked through the data most commonly presented in an ANOVA table and shown how to calculate and interpret each entry.

The final lecture expands the students' repertoire of designs to include 3+ level designs, fraction factorials, and others. The focus is on initial set up of the experiment (e.g. choosing the number and spacing of levels) and interpretation of results. (It is assumed that student will have access to software or a textbook to assist with detailed design and calculation.)

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Paul Funkenbusch, University of Rochester, 2015

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