

Statistical Methods: A Computer Program to Calculate Orthogonal Polynomial Coefficients

Shahrokh Khanizadeh¹

430 Boulevard Gouin, Agriculture Canada, Research Station, St-Jean-sur-Richelieu, Que. J3B 6Z8, Canada

Mamdouh A. Fanous²

21,111 Lakeshore Road, Macdonald College of McGill University, Ste-Anne-de-Bellevue, Que. H9X 1C0, Canada

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The Statistical Analysis System (1988) is a statistical software program commonly used in agricultural research. In a recent study, PC-SAS was identified as one of the easiest-to-use software programs available on the market (Milliken and Remmenga, 1989).

The General Linear Models (GLM) procedure of SAS is frequently used for performing regression analysis and orthogonal polynomials. Since orthogonal polynomials contrasts may have to be performed on unequally spaced quantitative treatment levels (e.g., four doses of an insecticide, etc.), a set of contrast coefficients must be generated, as they are not available through SAS. Coefficients for equally spaced treatment levels are readily found in the literature and most biometry books (Bliss, 1970; Steel and

Torrie, 1980). The only difference between equally spaced and unequally spaced treatment levels is in the derivation of appropriate orthogonal single-degrees-of-freedom contrast coefficients to represent the orthogonal polynomials. However, once the contrast coefficients are specified, the computational procedures to calculate appropriate sums of squares are the same for both cases.

The procedure for deriving the orthogonal polynomial coefficients for treatments with unequally spaced levels is complex and time-

consuming, especially when higher-degree polynomials are involved. Therefore, we have developed a user-friendly computer program (Khanizadeh, 1988) that uses Fisher's argument (1950) to obtain a recursion formula to compute coefficients for linear and higher-degree polynomials for equally or unequally spaced treatment levels. The program was developed on an IBM/AT 486 33Mhz 4MRAM using MS-DOS version 5.0 and GW-BASIC version 2.23 and then compiled to machine language with the Microsoft Basic Compiler. After execution, the user is asked to enter the number of levels for a factor (treatment) and its levels, at which point the program immediately generates sets of coefficients for linear, quadratic, and cubic regression lines. A screen dump (Fig. 1) illustrates the coefficients generated for a factor (treatment) with four equally spaced treatment levels (i.e., 1, 2, 3, or 4 ppm or 10, 20, 30, or 40 ppm of a herbicide). The program, Orthogonal Polynomial Contrasts, is part of a statistical software package (Khanizadeh, 1988) and available upon request from S.K. on 5.25- or 3.5-inch microflexible disks at a nominal cost (\$10.00). It can be run on an IBM-PC/XT/AT/PS or compatible with 512K memory (RAM) equipped with any type of monitor (TTL, CGA, EGA, VGA, etc.).

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¹Research Scientist, Assistant Professor, and Statistical Consultant.

²Associate Professor of Statistics.

General solution end up to the computation of the following orthogonal coefficients:			
Orthogonal polynomial coefficients			
Treatment levels	Linear	Quadratic	Cubic
1.0	-1.5000	1.0000	-0.3000
2.0	-0.5000	-1.0000	0.9000
3.0	0.5000	-1.0000	-0.9000
4.0	1.5000	1.0000	0.3000

Calculate another set of coefficients (y/n) ?

Fig. 1. A screen example generated by Orthogonal Polynomial Contrast for a factor (treatment) with four equally spaced levels (e.g., four herbicide doses).