Power and Sample Size for Random and Mixed Models; Calculation of Expected Mean Squares

Random effects: As explained in the text, when an exact F test is available of the form $F = MSN/MSD$ to test a variance component, power and sample size calculations for testing the random effect use the result that the F statistic under H_a is distributed as a multiple of a central F distribution (with the same degrees of freedom as under H_0), where the multiplier is:

$$\lambda^2 = \frac{E(MSN)}{E(MSD)}.$$

Fixed effects: When an exact F test is available of the form $F = MSN/MSD$ to test a fixed effect, then the F statistic under H_a follows a noncentral F distribution (with the same degrees of freedom as under H_0) and noncentrality parameter:

$$\lambda = \upsilon_n \left[\frac{E(MSN)}{E(MSD)} - 1\right],$$

where υ_n is the degrees of freedom for MSN.

Expected values of Mean Squares: The text presents a procedure for calculating expected values of mean squares for the unrestricted model with balanced designs. These results should match the results from SAS.