

Growth curve model with covariance structures

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0. Introduction

Potthoff and Roy [33] first proposed the growth curve model which is a generalized multivariate analysis of variance model. The growth curve model is defined as

$$(0.1) \quad Y = A \Xi B + \varepsilon,$$

$N \times p \quad N \times k \quad k \times q \quad q \times p \quad N \times p$

where Y is an observed random matrix, A and B are known design matrices of ranks k and $q \leq p$, respectively, Ξ is an unknown parameter matrix, and the rows of ε are independent and identically distributed random vectors with distribution $N_p(\mathbf{0}, \Sigma)$. In most applications of the model, p is the number of time points observed on each of the N subjects, $(q - 1)$ is the degree of the polynomial, and k is the number of groups. Especially, Rao [34] gave the analysis of such data for a single group of individuals by using a multivariate approach.

This model was studied by Potthoff and Roy [33] including Rao [34], [35], [37], Khatri [23], Grizzle and Allen [15], Timm [46], Lee [27], [28], Lee and Geisser [29], Reinsel [39], [40], Fujikoshi, Kanda and Tanimura [9], Kanda and Fujikoshi [22] and many others. A comprehensive review of growth curve analysis was given by Woolson and Leeper [50], and also has been recently given by von Rosen [42]. Many authors have considered