Third Order Response Surface Designs for Sequential Experimentation

Eldho Varghese[1*], Hemavathi M.[1,2], Shashi Shekhar[2] and Seema Jaggi[3]

[1]ICAR-Central Marine Fisheries Research Institute, Kochi, Kerala

[2]Institute of Agricultural Sciences, Banaras Hindu University, Varanasi, U.P.

[3]ICAR-Indian Agricultural Statistics Research Institute, New Delhi, India.

[*]Corresponding author Email: eldhoiasri@gmail.com

Abstract

Response surface methodology is being widely used in developing and improving the quality characteristics of process/product through response surface model based optimization. Second order rotatable designs (SORDs) are the most prominent and popular class of designs used for such optimization trials. When the response obtained from a second order rotatable design (SORDs) is modelled using a second order model, it may sometimes lead to significant *lack of fit* which indicate the inadequacy of the model. Then one may think of a third order model to establish a functional relationship between the response and the input variables. Experimenting with a new third order rotatable designs (TORDs) in such a situation would be expensive as the responses observed from the first stage runs would be kept underutilized. In this paper, construction of TORDs suitable for sequential experimentation has been discussed which allows the estimation of parameters of the second order model at first stage and further fitting of third order model with addition of few more design points.

Keywords: Response surface, third order, rotatable, sequential, cost-efficient design

Acknowledgment: Authors would like to acknowledge LBS award project of ICAR (Sanction vide F. No. 1(3)/2018.A.C.) and DST, Govt. of India (INSPIRE fellowship No. IF170536) for the financial assistance.

Reference:

M. Hemavathi, Eldho Varghese, Shashi Shekhar & Seema Jaggi (2020) Sequential asymmetric third order rotatable designs (SATORDs), *Journal of Applied Statistics*, DOI: 10.1080/02664763.2020.1864817