Response Surface Methodology for Mixture Experiments

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Abstract

Response Surface Methodology (RSM) for Mixture Experiments is an approach used to model and analyze mixture experiments. In these experiments, the factors represent components or ingredients of a mixture, and their levels are related to each other due to the constraint that the sum of all factor levels must be constant, usually equal to 1 or 100%. The main objective of RSM for mixture experiments is to optimize the mixture response, such as product properties or process performance. RSM uses mathematical models, such as polynomial or quadratic models, to describe the relationship between mixture factor levels and response. These models are then analyzed to identify the optimal factor levels that lead to maximum or minimum mixture response.For a three-component system, regression models can generally be set in the form of polynomials that are usually defined by the following Scheffé canonical forms: a) linear model, b) quadratic model, c) incomplete cube model, d) complete cube model, e) incomplete quartic model, and f) complete quartic model. The paper presents the Response surface methodology (RSM) of the three-component system experiments with mixtures. The methodology consists of the following phases:

- Input of experimental data
- Selection of possible canonical forms of regression models
- Calculation of regressin coefficients of models
- Checking the adequacy of the mathematical model
- Selection of optimal model
- Assesment of significance of regression koeficients
- Calculation the confidence interval of regression koeficients
- Calculation the confidence interval of model
- Graphical interpretation of the mathematical model

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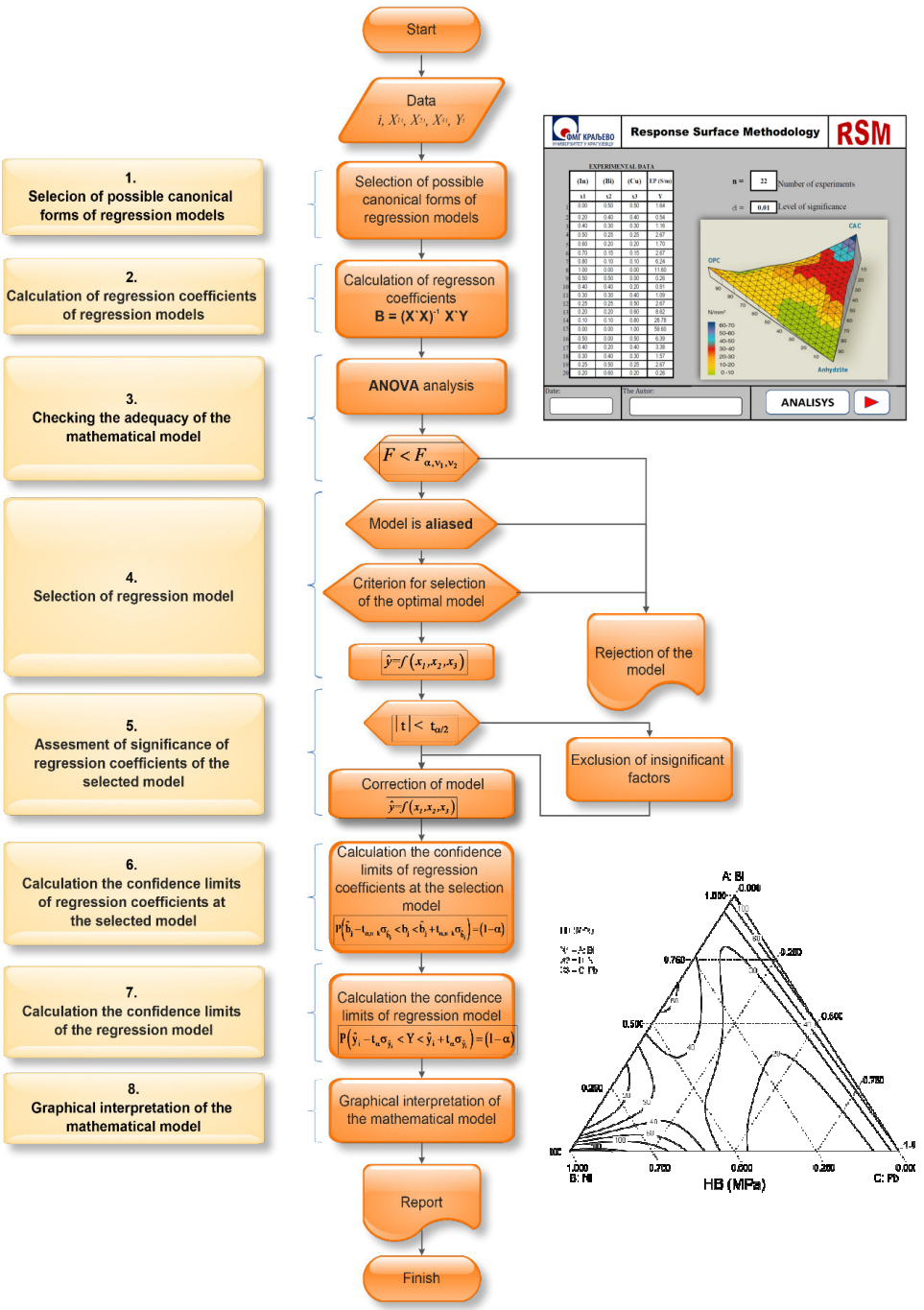
Graphical abstract:



Response Surface Methodology.