

## Index

- $2^2$  and  $2^3$  factors box EVOP calculations 239–241
- $2^2$  BEVOP simulation
- simulation No.1 100
    - phase 1 100–103
    - phase 2 103–106
    - phase 3 106–109
    - phase 4 109–112
    - phase 5 112–116
  - simulation No.2 117
    - phase 1 117–120
    - phase 2 120–123
    - phase 3 123–126
  - simulation No.3 127
    - phase 1 127–130
    - phase 2 130–133
- $2^3$  BEVOP simulation, simulation No.4 134
- phase 1 134–138
  - phase 2 138–143
  - phase 3 143–149
  - phase 4 148–154
- $2^3$  factorial design 7–16, 41–45, 185
- $2^3$  ROVOP simulation
- simulation No.6 186
    - phase 1 186–188
    - phase 2, cycle 1 188–190
    - phase 3, cycle 1 190–191
    - phase 4 191–193
    - phase 5 193–194
    - phase 6 194–196
  - simulation No.7 196–197
- $2^3$  three factors box EVOP calculations 240
- 2 S.E limits 241
  - of averages 240
  - effects using, Yates algorithm 241
  - of standard deviations 240–241
- b**
- basic simplex method 214–223
  - belt speed (RPM) settings 226
  - Box-Wilson Design 26
- c**
- catalytic cracking units 98
  - central composite rotatable design 26
  - Central Composite Rotatable Design-DOE 26
  - central composite rotatable design matrix 27
  - “Chemstrand” Corporation 98
  - Condition Fiber Strength (CONSTR) 18, 21, 24
  - confidence interval (CI) 205, 206
  - contour diagram 13–15, 41, 115, 126, 156, 157
- d**
- data collection system 94
  - data mining (DM) 1, 17–18, 30
    - building, training, and verifying model 19–21
  - data preprocessing 18–19

- data mining (DM) (*contd.*)  
 DOE experiment 26–28  
 model analyzing 21–24  
 What-Ifs optimization 25–26  
 data preprocessing 18–19  
 Design of Experiments (DOE) 1, 3–4  
    $2^3$  factorial design 7–9  
     effects for 9  
    $2^2$  factorial designs 4–5  
     effects for 6  
   interactions between factors 6–7  
   standard error, for effects 7  
   standard errors, two and three level  
     factorial designs 10–16  
   strategy 2  
 desirability approach 247–251
- e**  
 estimate of, sigma 40, 43–46, 50, 55,  
   59, 103, 106, 109, 112, 115, 120,  
   123, 138, 143, 148, 153, 160, 162,  
   164, 166, 168, 170, 172, 174, 176,  
   178, 180, 182, 184, 188, 190, 191,  
   193, 194, 196, 197, 237, 238, 239,  
   240  
 evolutionary operation (EVOP) 29  
    $2^3$  factorial design 41–42  
     dividing into, two blocks 45  
     standard deviation, estimate of  
       43–45  
     with two center points 45–47  
 analysis of, information board 34,  
   40–41  
 BEVOP  
   advantages & disadvantages 99  
   applications 96–99  
   in plant-scale experiments 93–96  
 box EVOP-BEVOP 49–50  
 calculation procedure, for three factors  
   54–93  
 calculation procedure, for two factors  
   50–54  
 change in mean, for  $2^2$  factorial design  
   38  
 current best-known conditions 36–37
- effects and standard errors  $2^2$  design  
   with center point 40  
 factors scheme 35  
 Information Board 54  
 practical advice 233–234  
 scale-up 29–30  
 small-scale and plant-scale  
   investigation 29  
 software 235–236  
 standard deviation 237–239  
 standard errors, for effects 38–40  
 static 30–33  
 evolutionary optimization 29
- f**  
 Factor's levels 27  
 factor variation interval 5, 218, 221  
 fine tuning 1, 117  
 fluidity averages 5
- g**  
 Gaussian distributions 206
- h**  
 Historical Databases-Data Historians 2  
 Hooke-Jeeves (HJ) method 205  
 hydrogen cyanide process 97
- i**  
 independent variables-factors 2, 25, 26
- l**  
 linear regression model 6
- m**  
 main effect of concentration 6, 39, 42  
 mean-CM effect 36  
 messy data 2, 26  
 method of static operation 30  
 Microsoft Excel calculation 246  
 Microsoft Excel simulation 100, 103,  
   117, 134, 158, 186, 201, 228, 231  
 mimic neuro-biological processes 17  
 multiple regression analysis 157

***n***

- neural network modeling 17  
 building, training and verifying model 19–21  
 data preprocessing 18–19  
 DOE Experiment 26–28  
 model analyzing 21–24  
 optimization 25–26  
 neural network modeling technique 1, 17

***o***

- on-line process computers 2, 25  
 optimization 1–3, 11, 15, 17, 18, 21, 25–26, 29, 30, 32, 33, 35, 93, 94, 95, 117, 127, 155, 185, 205, 214–216, 218, 219, 221–224, 227, 234, 235, 247, 250  
 optimization process 1, 25

***p***

- phase mean 37, 40, 109, 112, 115, 123, 133, 143, 148, 153, 172, 178, 180, 182, 184, 193, 194, 196, 197, 241  
 plant-scale technique 29  
 predictive modeling 17

***q***

- Quick-Start Evolutionary Operation (QSEVOP) 204  
 advantages 207–208  
 disadvantages 208  
 recovery from, hang-ups 207–208  
 simulation 208–214  
 working 204–207

***r***

- random errors 205, 206  
 random evolutionary operation (REVOP) 198  
 advantages 199  
 disadvantages 199  
 procedure 198  
 simulation 200–203  
 phase 1 201–203

- random normal deviates 100, 117, 127, 134, 201, 208, 243–244

regression coefficients 7

regression model 1, 6, 7, 9

relative error 20, 21

response surfaces 11–15, 28, 45, 99, 103, 115, 116, 120, 126, 130, 133, 138, 143, 153, 154, 157, 158, 160, 162, 164, 166, 168, 170, 172, 174, 185, 199, 208, 214, 215, 220, 228, 230

rotating square evolutionary operation (ROVOP)

$2^2$  ROVOP 155–157

method of analysis 157–158

advantages 158

disadvantages 158

simulation 149

phase 1 158–160

phase 1, cycle 2 160–162

phase 1, cycle 3 162–164

phase 1, cycle 4 164–166

phase 1, cycle 5 166–168

phase 1, cycle 6 168–170

phase 2, cycle 1 170–172

phase 2, cycle 2 172–174

phase 2, cycle 3 174–176

phase 3 176–178

phase 4, cycle 1 178–180

phase 5, cycle 1 180–182

phase 6, cycle 1 182–185

rough interpolation 41

rule of thumb 2

***s***

sensitivity analysis 18, 21

shockwave power reactor (SPR) 15–16

simplex circling 219, 221

simplex evolutionary operation (SEVOP) 223

advantages 225

basic simplex method 214–223

calculate, new run value 228

disadvantages 226

operations 224–225

- |   |   |
|---|---|
| simplex evolutionary operation (SEVOP)<br>(contd.)              | simplex optimization 214–216, 219, 221,<br>222, 227 |
| procedure 223–228   | statistical process control (SPC) 95,<br>234        |
| simulation S-9 228–231  |   |
| phase 1 228–231   | <b>t</b>  |
| simulation S-10, phase 1 231–233                                | tetrahedron, in coordinate system 216               |
| simplex movement 214, 215, 219, 220,<br>221, 227, 228, 230, 231 | two standard error limits 33, 46–47                 |

t

- tetrahedron, in coordinate system 216  
two standard error limits 33, 46–47