

ISO 7870-4:2021-09 (E)

Control charts - Part 4: Cumulative sum charts

| Contents | | Page |
|--------------------|--|-------------|
| Foreword | | v |
| Introduction | | vi |
| 1 | Scope | 1 |
| 2 | Normative references | 1 |
| 3 | Terms and definitions, abbreviated terms and symbols | 1 |
| 3.1 | Terms and definitions | 1 |
| 3.2 | Abbreviated terms | 2 |
| 3.3 | Symbols | 2 |
| 4 | Principal features of cumulative sum (CUSUM) charts | 3 |
| 5 | Basic steps in the construction of CUSUM charts -- Graphical representation | 4 |
| 6 | Example of a CUSUM plot -- Motor voltages | 5 |
| 6.1 | Process | 5 |
| 6.2 | Simple plot of results | 5 |
| 6.3 | Standard control chart for individual results | 6 |
| 6.4 | CUSUM chart construction | 7 |
| 7 | Fundamentals of making CUSUM-based decisions | 8 |
| 7.1 | Need for decision rules | 8 |
| 7.2 | Basis for making decisions | 8 |
| 7.3 | Measuring the effectiveness of a decision rule | 9 |
| 7.3.1 | Basic concepts | 9 |
| 7.3.2 | Example of calculation of ARL | 10 |
| 8 | Types of CUSUM decision schemes | 10 |
| 8.1 | V-mask | 10 |
| 8.1.1 | Configuration and dimensions | 10 |
| 8.1.2 | Application of the V-mask | 11 |
| 8.1.3 | Average run lengths | 14 |
| 8.1.4 | General comments on average run lengths | 15 |
| 8.2 | Fast-initial response (FIR) CUSUM | 16 |
| 8.3 | Tabular CUSUM | 16 |
| 8.3.1 | Rationale | 16 |
| 8.3.2 | Deployment | 17 |
| 9 | CUSUM methods for process and quality control | 19 |
| 9.1 | Nature of the changes to be detected | 19 |
| 9.1.1 | Size of the changes to be detected | 19 |
| 9.1.2 | 'Step' changes | 19 |
| 9.1.3 | Drifting | 19 |
| 9.1.4 | Cyclic | 19 |
| 9.1.5 | Hunting | 19 |
| 9.2 | Selecting target values | 19 |
| 9.2.1 | General | 19 |
| 9.2.2 | Standard (given) value as target | 20 |
| 9.2.3 | Performance-based target | 20 |

| | | |
|--|--|----|
| 9.3 | CUSUM schemes for monitoring location | 20 |
| 9.3.1 | Standard schemes | 20 |
| 9.3.2 | Standard schemes -- Limitations | 27 |
| 9.3.3 | 'Tailored' CUSUM schemes | 27 |
| 9.4 | CUSUM schemes for monitoring variation | 28 |
| 9.4.1 | General | 28 |
| 9.4.2 | CUSUM schemes for subgroup ranges | 29 |
| 9.4.3 | CUSUM schemes for subgroup standard deviations | 32 |
| 9.5 | Special situations | 36 |
| 9.5.1 | Large between-subgroup variation | 36 |
| 9.5.2 | 'One-at-a-time' data | 36 |
| 9.5.3 | Serial dependence between observations | 36 |
| 9.5.4 | Outliers | 37 |
| 9.6 | CUSUM schemes for discrete data | 38 |
| 9.6.1 | Event count -- Poisson data | 38 |
| 9.6.2 | Two classes data -- Binomial data | 40 |
| Annex A (informative)ExampleoftabularCUSUM | | 44 |
| Annex B (informative) Estimation of the change point when a step change occurs | | 48 |
| Bibliography | | 50 |