ISO 5725-3:2023-06 (E)

Accuracy (trueness and precision) of measurement methods and results - Part 3: Intermediate precision and alternative designs for collaborative studies

Contents

Page

Foreword ..... **v**

Introduction ..... **vi**

1 Scope **1**

2 Normative references **2**

3 Terms and definitions **2**

4 Symbols **3**

5 General requirements **4**

6 Intermediate measures of the precision of a standard measurement method **5**
6.1 Factors and factor levels 5
6.1.1 Definitions and examples 5
6.1.2 Selection of factors of interest 6
6.1.3 Random and fixed effects 6
6.1.4 Statistical model 7
6.2 Within-laboratory study and analysis of intermediate precision measures 9
6.2.1 Simplest approach 9
6.2.2 Alternative method 10
6.2.3 Effect of the measurement conditions on the final quoted result 10

7 Nested design **11**
7.1 Balanced fully-nested design 11
7.2 Staggered-nested design 12
7.3 Balanced partially-nested design 13
7.4 Orthogonal array design 14

8 Design for heterogeneous material **16**
8.1 Applications of the design for a heterogeneous material 16
8.2 Layout of the design for a heterogeneous material 17
8.3 Statistical analysis 17

9 Split-level design **17**
9.1 Applications of the split-level design 17
9.2 Layout of the split-level design 19
9.3 Statistical analysis 19

10 Design across levels **19**
10.1 Applications of the design across levels 19
10.2 Layout of the design across levels 20
10.3 Statistical analysis 20

11 Reliability of interlaboratory parameters **20**
11.1 Reliability of precision estimates 20
11.2 Reliability of estimates of the overall mean 21
11.2.1 General 21
11.2.2 Balanced fully-nested design (2 factors) 21
11.2.3 Staggered nested design (2 factors) 21
11.2.4 Balanced partially-nested design 21
11.2.5 Orthogonal array design 21
11.2.6 Split-level design 22

Annex A (informative) **Fully- and partially-nested designs** **23**
Annex B (informative) **Analysis of variance for balanced fully-nested design** **25**
Annex C (informative) **Analysis of variance for staggered design** **30**
Annex D (informative) **Analysis of variance for the balanced partially-nested design (three factors)** **38**
Annex E (informative) **Statistical model for an experiment with heterogeneous material** **41**
Annex F (informative) **Analysis of variance for split-level design** **42**
Annex G (informative) **Example for split-level design** **44**
Annex H (informative) **Design across levels** **47**
Annex I (informative) **Restricted maximum likelihood (REML)** **48**
Annex J (informative) **Examples of the statistical analysis of intermediate precision experiment** **49**
Annex K (informative) **Example for an analysis across levels** **55**
Bibliography **57**