
**Applications of statistical and related
methods to new technology and
product development process —
Robust parameter design (RPD)**

*Application de méthodologies statistiques et connexes pour le
développement de nouvelles technologies et de nouveaux produits —
Modèle paramétrique robuste*





COPYRIGHT PROTECTED DOCUMENT

© ISO 2014

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized otherwise in any form or by any means, electronic or mechanical, including photocopying, or posting on the internet or an intranet, without prior written permission. Permission can be requested from either ISO at the address below or ISO's member body in the country of the requester.

ISO copyright office
Case postale 56 • CH-1211 Geneva 20
Tel. + 41 22 749 01 11
Fax + 41 22 749 09 47
E-mail copyright@iso.org
Web www.iso.org

Published in Switzerland

Contents

Page

| | |
|---|-----------|
| Foreword | iv |
| Introduction | v |
| 1 Scope | 1 |
| 2 Normative references | 1 |
| 3 Terms and definitions and symbols | 1 |
| 3.1 Term and definitions | 1 |
| 3.2 Symbols | 3 |
| 4 Robust parameter design — Overview | 4 |
| 4.1 Requirements | 4 |
| 4.2 Assessing the robustness of a system | 4 |
| 4.3 Robustness assessment through SN ratio | 6 |
| 4.4 An efficient method for assessing technical ideas — Parameter design | 7 |
| 4.5 Two-step optimization (Strategy of parameter design) | 8 |
| 4.6 Determination of the optimum design | 10 |
| 5 Assessment of robustness by SN ratio | 10 |
| 5.1 Concepts of SN ratio | 10 |
| 5.2 Types of SN ratio | 11 |
| 5.3 Procedure of the quantification of robustness | 11 |
| 5.4 Formulation of SN ratio: Calculation using decomposition of total sum of squares | 13 |
| 5.5 Some topics of SN ratio | 19 |
| 6 Procedure of a parameter design experiment | 20 |
| 6.1 General | 20 |
| 6.2 (Step 1) Clarify the system's ideal function | 20 |
| 6.3 (Step 2) Select a signal factor and its range | 21 |
| 6.4 (Step 3) Select measurement method of output response | 21 |
| 6.5 (Step 4) Develop noise strategy and select noise factors and their levels | 21 |
| 6.6 (Step 5) Select control factors and their levels from design parameters | 22 |
| 6.7 (Step 6) Assign experimental factors to inner or outer array | 22 |
| 6.8 (Step 7) Conduct experiment and collect data | 23 |
| 6.9 (Step 8) Calculate SN ratio, η , and sensitivity, S | 23 |
| 6.10 (Step 9) Generate factorial effect diagrams on SN ratio and sensitivity | 26 |
| 6.11 (Step 10) Select the optimum condition | 28 |
| 6.12 (Step 11) Estimate the improvement in robustness by the gain | 28 |
| 6.13 (Step 12) Conduct a confirmation experiment and check the gain and "reproducibility" | 29 |
| 7 Case study — Parameter design of a lamp cooling system | 30 |
| Annex A (informative) Comparison of a system's robustness using SN ratio | 40 |
| Annex B (informative) Case studies and SN ratio in various technical fields | 47 |
| Bibliography | 72 |