ISO 27852:2024-02 (E)

Space systems - Estimation of orbit lifetime

Contents

Page

Foreword iv

Introduction v

1 Scope 1

2 Normative references 1

3 Terms,definitions,symbolsandabbreviatedterms 1
3.1 Terms and definitions 1
3.2 Symbols 5
3.3 Abbreviated terms 5

4 Orbit lifetime estimation 5
4.1 General requirements 5
4.2 Definition of orbit lifetime estimation process 6

5 Orbit lifetime estimation methods and applicability 6
5.1 General 6
5.2 Method 1: high-precision numerical integration 7
5.3 Method 2: rapid semi-analytical orbit propagation 7
5.4 Method 3: numerical table look-up, analysis and fit equation evaluations 8
5.5 Orbit lifetime sensitivity to Sun-synchronous orbit conditions 8
5.6 Orbit lifetime statistical approach for high-eccentricity orbits (e.g. GTO) 8

6 Atmospheric density modelling 14
6.1 General 14
6.2 Atmospheric drag models 14
6.3 Long-duration solar flux and geomagnetic indices prediction 17
6.4 Method 1: Monte Carlo random draw of solar flux and geomagnetic indices 18
6.5 Method 2: predicted F10.7 Bar solar activity prediction profile 24
6.6 Method 3: equivalent constant solar flux and geomagnetic indices 24
6.7 Method 4: reference solar forcing scenario 28

7 Atmospheric density implications of thermospheric global cooling 28

8 Estimatingballisticcoefficient() 29
8.1 General 29
8.2 Estimating aerodynamic force and solar radiation pressure coefficients 29
8.2.1 General 29
8.2.2 Aerodynamic and solar radiation pressure coefficient estimation via a "panel model" 29
8.2.3 Hypersonic rarefied gas flow adjustments via the Knudsen number and other considerations 33
8.3 Estimating cross-sectional area with tumbling and stabilization modes 33
8.4 Estimating mass 34

Annex A (informative) Space population distribution 35

Annex B (informative) 25-year lifetime predictions using random draw approach 38

Annex C (informative) Solar radiation pressure and 3rd-body perturbations 44

Bibliography 46