

Contents

1	Introduction	1
1.1	Principle of Operation and Classification	1
1.2	CVG Classification	3
1.3	Sensitive Element Designs	4
2	Motion Equations of Coriolis Vibratory Gyroscopes	15
2.1	Translational Sensitive Element Motion Equations	15
2.2	Rotational Sensitive Element Motion Equations	19
2.3	Tuning Fork Sensitive Element Motion Equations	23
2.4	Ring-Shaped Sensitive Element Motion Equations	25
2.5	Generalised Motion Equations	26
3	Sensitive Element Dynamics	29
3.1	Primary Motion of the Sensitive Element	29
3.2	Sensitive Element Motion on a Rotating Base	31
3.3	Modelling Proof Mass Motion Trajectory	38
3.4	Numerical Simulation of CVG Dynamics Using Simulink®	44
4	CVG Dynamics in Demodulated Signals	47
4.1	Motion Equations in Demodulated Signals	47
4.2	CVG Transfer Functions	50
4.3	Amplitude and Phase Responses	52
4.4	Stability and Transient Process Optimisation	53
4.5	Simplified CVG Transfer Function and Its Accuracy	57
4.6	Trajectory Rotation Transfer Function	58

5 Sensitive Element Design Methodologies	63
5.1 Optimal Excitation of the Primary Oscillations.	63
5.2 Scale Factor and Its Linearity	72
5.3 Resolution and Dynamic Range	76
5.4 Bias	79
5.5 Dynamic Error and Bandwidth.	82
6 Signal Processing and Control	87
6.1 Process and Sensor Noises in CVG	87
6.2 Sensor Noise Optimal Filtering	88
6.3 Process Noise Optimal Filtering	92
6.4 Optimal Kalman Filter Synthesis	94
6.5 Cross-Coupling Compensation	98
6.6 Temperature Errors Compensation	105
6.7 Whole-Angle Force Rebalance Control	111
Further Reading	115



<http://www.springer.com/978-3-319-22197-7>

Coriolis Vibratory Gyroscopes

Theory and Design

Apostolyuk, V.

2016, VIII, 117 p. 84 illus., Hardcover

ISBN: 978-3-319-22197-7