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Nota di contenuto	Cover; Title Page; Copyright Page; Table of Contents; Introduction; PART I. MINI AND MICROSYSTEMS; Chapter 1. Modeling and Control of Stick-slip Micropositioning Devices; 1.1. Introduction; 1.2. General description of stick-slip micropositioning devices; 1.2.1. Principle; 1.2.2. Experimental device; 1.3. Model of the sub-step mode; 1.3.1. Assumptions; 1.3.2. Microactuator equation; 1.3.3. The elastoplastic friction model; 1.3.4. The state equation; 1.3.5. The output equation; 1.3.6. Experimental and simulation curves; 1.4. PI control of the sub-step mode; 1.5. Modeling the coarse mode 1.5.1. The model1.5.2. Experimental results; 1.5.3. Remarks; 1.6. Voltage/frequency (U/f) proportional control of the coarse mode; 1.6.1. Principle scheme of the proposed controller; 1.6.2. Analysis; 1.6.3. Stability analysis; 1.6.4. Experiments; 1.7. Conclusion; 1.8. Bibliography; Chapter 2. Microbeam Dynamic Shaping by Closed-loop Electrostatic Actuation using Modal Control; 2.1. Introduction; 2.2. System description; 2.3. Modal analysis; 2.4. Mode-based control; 2.4.1. PID control; 2.4.2. FSF-LTR control; 2.5. Conclusion; 2.6. Bibliography; PART II. NANOSYSTEMS AND NANOWORLD

Chapter 3. Observer-based Estimation of Weak Forces in a Nanosystem Measurement Device 3.1. Introduction; 3.2. Observer approach in an AFM measurement set-up; 3.2.1. Considered AFM model and force measurement problem; 3.2.2. Proposed observer approach; 3.2.3. Experimental application and validation; 3.3. Extension to back action evasion; 3.3.1. Back action problem and illustration; 3.3.2. Observer-based approach; 3.3.3. Simulation results and comments; 3.4. Conclusion; 3.5. Acknowledgements; 3.6. Bibliography

Chapter 4. Tunnel Current for a Robust, High-bandwidth and Ultraprecise Nanopositioning 4.1. Introduction; 4.2. System description; 4.2.1. Forces between the tip and the beam; 4.3. System modeling; 4.3.1. Cantilever model; 4.3.2. System actuators; 4.3.3. Tunnel current; 4.3.4. System model; 4.3.5. System analysis; 4.4. Problem statement; 4.4.1. Robustness and non-linearities; 4.4.2. Experimental noise; 4.5. Tools to deal with noise; 4.5.1. Kalman filter; 4.5.2. Minimum variance controller; 4.6. Closed-loop requirements; 4.6.1. Sensitivity functions; 4.6.2. Robustness margins; 4.6.3. Templates of the sensibility functions 4.7. Control strategy; 4.7.1. Actuator linearization; 4.7.2. Sensor approximation; 4.7.3. Kalman filtering; 4.7.4. RST1 synthesis; 4.7.5. z reconstruction; 4.7.6. RST2 synthesis; 4.8. Results; 4.8.1. Position control; 4.8.2. Distance d control; 4.8.3. Robustness; 4.9. Conclusion; 4.10. Bibliography;

Chapter 5. Controller Design and Analysis for High-performance STM; 5.1. Introduction; 5.2. General description of STM; 5.2.1. STM operation modes; 5.2.2. Principle; 5.3. Control design model; 5.3.1. Linear approximation approach; 5.3.2. Open-loop analysis

Sommario/riassunto

Micro and nanosystems represent a major scientific and technological challenge, with actual and potential applications in almost all fields of the human activity. The aim of the present book is to present how concepts from dynamical control systems (modeling, estimation, observation, identification, feedback control) can be adapted and applied to the development of original very small-scale systems and of their human interfaces. The application fields presented here come from micro and nanorobotics, biochips, near-field microscopy (AFM and STM) and nanosystems networks. Alina Voda has drawn
