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Titolo	Active Probe Atomic Force Microscopy [[electronic resource]] : A Practical Guide on Precision Instrumentation / / by Fangzhou Xia, Ivo W. Rangelow, Kamal Youcef-Toumi
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Altri autori (Persone)	RangelowIvo W Youcef-ToumiKamal
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Soggetti	Measurement Measuring instruments Electronics Mechatronics Spectrum analysis Microtechnology Microelectromechanical systems Measurement Science and Instrumentation Electronics and Microelectronics, Instrumentation Spectroscopy Microsystems and MEMS
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Nota di contenuto	Introduction -- Active Probe Design and Fabrication -- Advanced Applications of Active Probes -- Atomic Force Microscope Designs -- AFM System using Active Probe -- A Low-cost AFM Design for Engineering Education -- Appendix.
Sommario/riassunto	From a perspective of precision instrumentation, this book provides a guided tour to readers on exploring the inner workings of atomic force microscopy (AFM). Centered around AFM, a broad range of mechatronic system topics are covered including mechanics, sensors, actuators, transmission design, system identification, signal processing, dynamic

system modeling, controller. With a solid theoretical foundation, practical examples are provided for AFM subsystem level design on nano-positioning system, cantilever probe, control system and system integration. This book emphasizes novel development of active cantilever probes with embedded transducers, which enables new AFM capabilities for advanced applications. Full design details of a low-cost educational AFM and a Scale Model Interactive Learning Extended Reality (SMILER) toolkit are provided, which helps instructors to make use of this book for curriculum development. This book aims to empower AFM users with deeper understanding of the instrument to extend AFM functionalities for advanced state-of-the-art research studies. Going beyond AFM, materials presented in this book are widely applicable to precision mechatronic system design covered in many upper-level graduate courses in mechanical and electrical engineering to cultivate next generation instrumentalists. Presents the instrument design details of atomic force microscopy with focus on active cantilever probes; Includes examples and exercises to boost understanding of AFM subsystem design, fabrication and integration; Imparts a hands-on curriculum for precision mechatronics and instrumentation with AFM and digital twin simulators.