Lock-In, Phase Locked Loop and Proportional-Integral Controllers

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Best results in NC-AFM measurements can be achieved when the operator knows the technology of the microscope and the function of basic components well and is confident in its operation. Starting out from the basic principles of the Lock-In technique, Phase Locked Loop (PLL) and Proportional-Integral (PI) Controllers, this presentation will explain the basics of non-contact AFM detection electronics, discuss some of the design choices made for the RHK R9 controller and make us aware of some common pitfalls in NC-AFM controller design and how to avoid them. Furthermore, it will be shown how, using "elementary" NC-AFM technology building blocks, complex measurement schemes like Kelvin Probe Force Microscopy (KPFM) can be built up.