



Scientific Instruments — and — Phase Noise and Frequency Stability in Oscillators

Lectures for PhD Students and Young Scientists

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Part 1: General

Part 2: Phase noise and oscillators

Part 3: The International System of Units SI

home page <http://rubiola.org>

Agenda

Part	Lecture	When	Course
1	1–5	March 1, 4, 8, 11, 15	Both
2	6–10	March 18, 22, 25, 29, April 1	Phase Noise and Frequency Stability in Oscillators
3	11–15	April 26, 29, May 3, 6, 10	Scientific Instruments

You choose	You attend
Phase Noise and Frequency Stability in Oscillators	Lectures 1–10
Scientific Instruments	Lectures 1–5 and 11–15
Both	All lectures

Origin and Purposes

The contents originates from

- My tutorials at int'l conferences and my lectures as a guest scientist in other labs
- Long term interests in the foundation of metrology
- Lab experience which does not fit elsewhere

Formally, a series of lectures for PhD students

In practice, [open to everybody](#)

No need to be a university student

Mandatory [e-mail registration](#) at

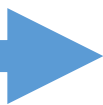
[formations \[dot\] doctorales \[at\] univ-fcomte \[dot\] fr](mailto:formations[dot]doctorales[at]univ-fcomte[dot]fr)

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They are instructed to accept everybody

Syllabus

- PhD Lectures



Contents
News
Enrico's Noise Chart
Publications
• books
• open literature
• journal articles
• conference articles
• conference slides
• seminar slides $\geq 1H$
EFTS
Syllabus
• PhD lectures
• Regular courses
• U. Henri Poincaré
• Politecnico di Torino
Local seminars recent and forthcoming
Oscillator noise support material for my book (Cambridge, 2008)
Opportunities
• Ph.D. opportunities
• Other opportunities
Affiliations
Links



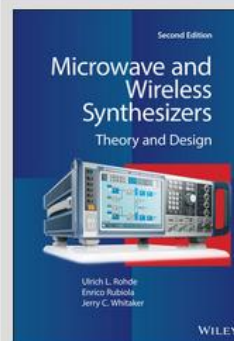
Enrico Rubiola home page

<http://rubiola.org>
also <http://rubiola.net>

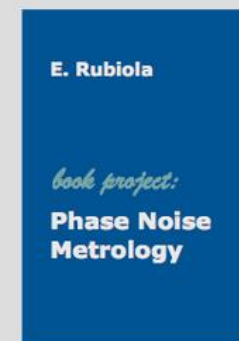
e-mail: [enrico\[at\]rubiola\[dot\]org](mailto:enrico[at]rubiola[dot]org)
replace "at" = "@" and "dot" = "."

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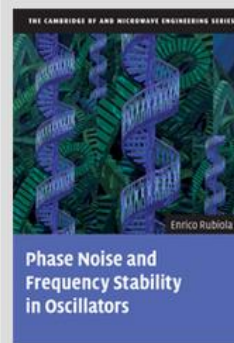
Books



U. L. Rohde, E. Rubiola,
J. C. Whitaker
*Microwave and wireless
synthesizers*
John Wiley & Sons, Nov. 2020
ISBN
978-1-119-66600-4 Hardcover



E. Rubiola
Phase noise metrology
Book project



E. Rubiola,
*Phase noise and frequency
stability in oscillators*
Cambridge University Press,
2008, 2010, 2012
ISBN
978-0-521-15328-7 Paperback
978-1-139-23940-0 Adobe eBook
Get supplementary material



E. Rubiola,
*Phase noise and frequency
stability in oscillators*
Science Press, June 2014
Simplified Chinese translation of
the Cambridge edition
ISBN
978-7-03-041231-7 Paperback

Please fill the online inquiry

- Mandatory for the validation of your training
- Best done immediately after you receive the link from the PhD School
- Should take 10 M

	Date	No	Contents
P1: Oscillators & SI	Mon 1/3	1	Noise: quantum, thermal, shot
	Thu 4/3	2	Flicker. Instrument (structure). Rothe Dahlke. Guarding & shielding. Noise temperature, noise factor, noise figure
	Mon 8/3	3	Photodiode. NEP. Analog meets digital (no architectures). Fourier analysis
	Thu 11/3	4	Cross spectrum: theory and applications
	Mon 15/3	5	Spectrum analyzer. Time-to-digital and frequency-to-digital converters
P2: Oscillators	Thu 18/3	6	Phase noise, basic concepts. Allan variances, start
	Mon 22/3	7	Allan variance (cont.). Experimental methods, problem with the Rohde oscillator
	Thu 25/3	8	----- Interferometer. Amplifiers. Noise in digital systems
	Mon 29/3	9	The Leeson effect
	Thu 1/4	10	The Pound Drever Hall frequency control
P3: SI	Mon 26/4	11	
	Thu 29/4	12	
	Mon 3/5	13	
	Thu 6/5	14	
	Mon 10/5	15	

The lectures on
- Scientific Instruments
- Phase Noise and Frequency Stability in Oscillators
start at 8:30 AM

When you log in, please send a chat message with

First Last name

for the list of participants to be sent to the PhD School

During the lecture, please

- Turn the **cam on** (you may turn it off if you don't have enough bandwidth), this makes me more comfortable
- Turn the **micro off**, turn it on only when you speak, this eliminates the noise
- You may like to **turn on captions** (set captions to English for a decent transcription)