



Masterclass Hands-on Lab Course on Waveform

Advanced Course

1. COURSE DETAILS

Participation Fee: EUR 2,000

Masterclass Registration: iprint.center/education

2. TWO-DAY PROGRAM

The focus of the course is to train participants in assessing, developing and improving waveforms for a drop on demand inkjet printheads as well as to be familiar with measures for reliable printhead operation. Hands-on practical lab work is supported by short theoretical lessons.

Lab work is done in small groups on drop watching platforms, each of them equipped with a Ricoh MH5421F print head jetting water-based or UV-based inks.

3. ADMISSION REQUIREMENTS

The course is open to all participants who have:

- completed the Foundation Course in inkjet engineering and inkjet chemistry at the iPrint Institute and/or
- basic understanding of rheology and waveforms

4. BACKGROUND

In piezo drop on demand (DoD) inkjet print heads, ink droplets are generated due to pressure waves introduced by the motion of piezoelectric actuators which are in turn controlled by an electrical signal called the waveform. As the propagation time (which is the speed of sound of the jetted fluid in relation to the channel length) of the pressure waves in an inkjet channel is significantly larger than the time needed for the piezoelectric actuator to reach its full amplitude, acoustic interference effects dominate the jetting process. A piezo inkjet channel can be seen as an acoustic resonator where pressure waves are reflected with the same polarity on closed ends or with inverse polarity at open ends. Each movement of the piezoelectric actuator creates a new pressure wave, which is resonating in the inkjet channel (with a certain attenuation per cycle) and can constructively (pressure amplification) or destructively (pressure attenuation) interfere with previously created pressure waves.

One of the major factors affecting the quality and reliability of piezo drop on demand (DoD) inkjet printing machines is the design of the waveform. While there are limitations on possible jetting performance due to the rheological properties of the ink, to achieve highest jetting quality or print speed, the waveform has to be properly adjusted.



5. ADVANCED WAVEFORM

After attending the training, you should:

- Find common error sources of the printhead and in the ink supply system
- Be familiar with test equipment and methodologies
- Understand inkjet acoustics and pulse timing to amplify or dampen pressure waves for waveform design
- Know the key differences when optimizing different ink types (Aqueous & Solvent, UV, Hot-Melt)
- Define maintenance intervals as well as print start sequences based on open nozzle time measurements
- Predict same drop speed waveform scaling for printheads of the same series with a different voltage rating
- Know waveform design features and limitations with major print head drive concepts
- Know basic techniques on improving jetting performance with single and multi-drop waveforms

6. JOHANNES RENNER

The Masterclass will be led by Johannes Renner. Johannes Renner studied mechatronics with specialization in automation technology at the Secondary Federal College of Engineering in Vienna, and machinery engineering as well as mechatronics at the Bern University of Applied Sciences, where he worked after graduation in 2007 as scientific assistant and later on as scientific officer for the Institute of Print Technology. In 2013 he joined the iPrint institute in Fribourg. Johannes has gained over 10 years of experience in applied research with the focus on inkjet technology and is contributing to many of iPrint's inkjet-related projects in management and development.