FIL3010 Inkjet Printing Technology 7.5 credits

Bläckstråleutskriftsteknik

This is a translation of the Swedish, legally binding, course syllabus.

If the course is discontinued, students may request to be examined during the following two academic years

Establishment

Course syllabus for FIL3010 valid from Autumn 2011

Grading scale

Education cycle

Third cycle

Specific prerequisites

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Language of instruction

The language of instruction is specified in the course offering information in the course catalogue.

Intended learning outcomes

This seminar will give in an introduction into inkjet printing technology, comprising the fundamental physical principles of drop generation in the different types of inkjet tech-

nologies, the relationship between fluid rheology and the drop formation process, and the manufacturing processes of the various types of actuators (Microsystems technology, MEMS). Thereafter the course will focus on the various application areas from desktop inkjet printing to the well established field of'digital printing'and into the emerging field of'digital fabrication', where the industrial inkjet printheads are used to print'functional fluids'in an ever growing number of applications including electronics, displays, data storage, optical, biological, medical applications etc.

The iPack project at KTH, which combines inkjet printing of graphics and functional fluids to produce'smart packaging'products will be treated as further example of'digital fabrication'.

Apart from seminar presentations and discussions there will be several hands-on training sessions in the labs of XaarJet AB.

Course contents

A short layout of the course:

(1) Overview and history of inkjet technologies

(2) Continuous Inkjet Technologies

- Fundamental physics of drop formation (Rayleigh)

- First applications (Siemens Elema)

- Development of Continous Inkjet Technologies

- Early, present, future applications

(3) Bubble Jet

- Fundamental physics of drop formation

- Development of BubbleJet Inkjet Technologies (Canon, HP, etc)

- Early, present, future applications

(4) Piezo Inkjet Printheads

- physics of piezo crystals

- different types of piezo inkjet actuators

(5) Manufacturing Processes of Industrial Inkjet Actuators

- Microsystems Engineering

- MEMS

- Manufacturing processes of actuators, nozzles etc

(6) Drop formation in piezo shared-wall inkjet printheads

- Acoustic generation
- Electrical driving‘waveforms’
- Stroboscopic imaging of drop formation
- Details of drop formation
- Satellites and misting
- Metrology of print quality

(7) Inks and‘Funtional Fluids’

- Solvent-, oil-, water-based, UV-curing fluids, phase-change fluids
- Dispersions and suspensions
- Nano-particle and CNT-fluids
- Rheology and measurement technologies

(8) Pre- and Post-Processes for Inkjet Printing Applications

- Wetting and non-wetting surfaces
- Pattern formation on substrates
- ‘coffee stain effect’
- Drying, curing and sintering

(9) Applications of Industrial Inkjet Printing:‘Digital Imaging’

- Inkjet Printing in comparison with Offset-, Flexo-, Gravure-, and Screen printing
- Wide- and Grand-Format printing
- High Throughput Industrial Printing

(10) ‘Digital Fabrication’: Inkjet Printing With‘Functional Fluids’

- Nano-particles: special properties in the nano world and their impact on digital fabrication
- Formulations of functional fluids for inkjet printing (nano-particles and nano-tube suspensions, polymer solutions, ceramic fluids, bio-fluids etc)
- Applications (electronics, displays, data storage, optical, biological, medical applications etc

Disposition

Structure of the Course:

- Weekly seminar presentations and discussion (2 hours) or hands-on training (half day)

- Seminar presentations by Prof Werner Zapka or external experts ,

- Seminar presentations by students on selected topics

- Hands-on training in the labs of XaarJet AB

- Examination (written)

Course literature

A list of literature (textbooks and journal papers) will be distributed at course start

Examination

Based on recommendation from KTH's coordinator for disabilities, the examiner will decide how to adapt an examination for students with documented disability.

The examiner may apply another examination format when re-examining individual students.

Grading scale P/F

Ethical approach

- All members of a group are responsible for the group's work.
- In any assessment, every student shall honestly disclose any help received and sources used.
- In an oral assessment, every student shall be able to present and answer questions about the entire assignment and solution.