Annex 1 to the agreement on CLUSTER Dual Masters between UCL and KTH

Appendix A

CLUSTER Dual Master Agreement between

Kungliga Tekniska högskolan (KTH) and Université Catholique de Louvain (UCL)

Duration: Academic Year 19/20 to 23/24

Degree programme at KTH:	**Master's Program in Applied and Computational Mathematics** (120 ECTS)
Degree awarded:	M.Sc.
Language of instruction	English
Entrance admission criteria:	Bachelor's degree in Science or Engineering
Degree programme at UCL:	**Master's Program in Mathematical Engineering** (120 ECTS)
Degree awarded:	Master in Mathematical Engineering (Master : ingénieur civil en mathématiques appliqués)
Language of instruction	English
Entrance admission criteria:	Bachelor's degree in Science or Engineering
Number of students	2

Schematic Study Plan

Option 1			
Year	Institution	Studies	Remarks
1	UCL	Compulsory and elective courses	60 ECTS
2	KTH	Courses + Master Thesis (examiner at both universities)	30+30 ECTS
Option 2			
Year	Institution	Studies	Remarks
1	KTH	Compulsory and elective courses	60 ECTS
2	UCL	Courses + Master Thesis (examiner at both universities)	30+30 ECTS
The schematic study plan is applicable to students originated from UCL or KTH indifferently. The detailed study plan must be defined by the academic coordinators for each student.			

Contacts:

Academic responsible for the programme at KTH: Assoc. Prof. Michael Hanke	Academic responsible for the programme at UCL: Prof. Michel Verleysen
Contact person: Assoc. Prof. Michael Hanke (hanke AT kth.se)	Contact person Prof. Pierre-Antoine Absil (PA.Absil AT uclouvain.be)

Signatures:

Date:	Date:
For KTH	For UCL
Per Berglund Vice Dean of Faculty KTH	Prof. Michel Verleysen Dean, Louvain School of Engineering UCL
Leif Kari Dean, School of Engineering Sciences KTH	Prof. Pierre-Antoine Absil, head of the MAP programme commission

Dual Master in Mathematical Engineering

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Dual Master in Mathematical Engineering

Plan for Cluster Dual Degree (120 ECTS)

KTH/Department of Mathematics

(hanke AT kth.se)
Master's Degree in Applied and Computational Mathematics
2 year program, language of instruction: English

Admission criteria

Basic eligibility requirements

A completed Bachelor's degree, equivalent to a Swedish Bachelor's degree (180 university credits), from a university recognized by government or accredited by other recognized organization. A good knowledge of written and spoken English. Applicants must provide proof of their proficiency in English, see http://www.kth.se/ for details.

Specific eligibility requirements

The prerequisites for the Master's program in Applied and Computational Mathematics is a Swedish or foreign degree equivalent to Bachelor of Science of 180 university credits, with at least 45 university credits in mathematics. The students are required to have documented knowledge corresponding to basic university courses in analysis in one and several variables, linear algebra, numerical analysis, differential equations and transforms, and mathematical statistics. The students are also required to have knowledge and training in basic programming.

Selection process

The selection process is based on a total evaluation of the following criteria: university, grades in courses relevant to the program: mathematics in a wide sense, and motivation letter. In addition, English language skills above the minimum requirements will give a higher overall evaluation score. Complete information on the eligibility requirements can be found in the local admission policy of KTH.

Specific requirements for second year students

Second year students entering KTH must satisfy first year's admission requirements. Additionally, students must have obtained the ECTS of courses equivalent to the mandatory courses of the KTH program or propose a second year program fulfilling the KTH degree requirements. The student must have selected a specialization in agreement with the program coordinator at KTH.

KTH degree requirements
- the minimum requirements for conferring KTH degree are the following:
    o **at least 55 ECTS** in KTH, which do not necessarily include the thesis.
- in practice first year or second year students at KTH are possible.
- thesis: 30 ECTS. The thesis will be graded on the A-F scale.
- The common requirements for cluster dual degrees apply (see **Cooperation Agreement on Cluster Dual Masters**).

Dual Master in Mathematical Engineering

<u>UCL/School of Engineering</u>

(PA.Absil AT uclouvain.be)

Master of Science in Mathematical Engineering (Master : ingénieur civil en mathématiques appliquées)

Language of instruction: English

Admission criteria

Basic eligibility requirements

A Bachelor of science in engineering (180 ECTS) from a CLUSTER institution. Other applications are handled on a case-by-case basis.

Specific eligibility requirements

A reasonable bachelor-level background is expected in the following three domains: optimization; systems and control; computational mathematics (numerical analysis). Otherwise, the student is expected to make up for the missing background by taking adequate introductory courses. The student must have developed methodological and practical skills.

Selection process

Students are required to lodge an application with the academic commission of the Master in Applied Mathematics, including a detailed curriculum vitae (year-by-year list of courses and grades). The commission proposes a course of studies adapted to the student's situation.

Complete information on the eligibility requirements can be found at https://uclouvain.be/en-prog-map2m-cond_adm.

Specific requirements for second year students

Second year students entering UCL must satisfy first year's admission requirements. Additionally, students must have obtained the ECTS of courses equivalent to the mandatory courses of the UCL program or propose a second year program fulfilling the UCL degree requirements. The student should have chosen a master thesis topic in agreement with one supervisor at UCL. The list of proposed topics is made available during the spring semester of the first master year.

UCL degree requirements
- the minimum requirements for conferring the above mentioned UCL degrees are the following:
    o **at least 55 ECTS** in UCL, which do not necessarily include the master thesis.
- in practice first year or second year at UCL are possible.
- Master thesis + seminar: 30 ECTS
- The common requirements for cluster dual degrees apply (see **Cooperation Agreement on Cluster Dual Masters**).

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<u>Suggested Schedule of Studies</u>

List by topic

Mandatory:
- AK2040 (7.5 ECTS p1) Theory and methodology of science with applications
- SF2520 (7.5 ECTS p1-2) Applied numerical methods, **exempted if** LINMA2710 (5 ECTS q2) Scientific computing
- SF2940 (7.5 ECTS p1) Probability theory, **exempted if** LINMA2470 (5 ECTS q2) Discrete stochastic models
- SF2832 (7.5 ECTS p2) Mathematical systems theory, **exempted if** LINMA2671 (5 ECTS q1) Advanced control and applications **and** LINMA1731 (5 ECTS q2) Stochastic processes: estimation and prediction
- LINMA2370 (5 ECTS q1) Modelling and analysis of dynamical systems, **exempted if** SF2832 (7.5 ECTS p2) Mathematical systems theory
- LINMA2380 (5 ECTS q1) Matrix computations, **exempted if** SF2524 (7.5 ECTS p2) Matrix computations for large-scale systems
- LINMA2470 (5 ECTS q2) Discrete stochastic models, **exempted if** SF2940 (7.5 ECTS p1) Probability theory
- LINMA2471 (5 ECTS q1) Optimization models and methods, **exempted if** SF2812 (7.5 ECTS p3) Applied linear optimization
- LINMA2710 (5 ECTS q2) Scientific computing, **exempted if** SF2520 (7.5 ECTS p1-2) Applied numerical methods
- Master thesis (30 ECTS)

Elective courses:
- 30 credits to be chosen among KTH's four specializations (http://www.kth.se/en/studies/programmes/master/programmes/physics-mathematics/applied-and-computational-mathematics) and UCL's majors for the Master's degree in mathematical engineering (https://uclouvain.be/en-prog-map2m-options)
- Additional credits may be chosen according to each program's rules in order to reach a total of 120 credits for the master

A typical course of studies: First year at KTH, second year at UCL

KTH:
- AK2040 (7.5 ECTS p1) Theory and methodology of science with applications
- SF2520 (7.5 ECTS p1-2) Applied numerical methods
- SF2940 (7.5 ECTS p1) Probability theory
- SF2832 (7.5 ECTS p2) Mathematical systems theory
- SF2812 (7.5 ECTS p3) Applied linear optimization
- Elective courses (to reach a total of at least 60 credits for year 1)

UCL:
- LINMA2380 (5 ECTS q1) Matrix computations
- Elective courses (at least 25 credits)
- Master thesis (and seminar)

Dual Master in Mathematical Engineering

A typical course of studies: First year at UCL, second year at KTH

UCL:
- LINMA2370 (5 ECTS q1) Modelling and analysis of dynamical systems
- LINMA2380 (5 ECTS q1) Matrix computations
- LINMA2470 (5 ECTS q2) Discrete stochastic models
- LINMA2471 (5 ECTS q1) Optimization models and methods
- LINMA2710 (5 ECTS q2) Scientific computing
- LINMA2671 (5 ECTS q1) Advanced control and applications
- Elective courses (to reach a total of at least 60 credits for year 1)

KTH:
- AK2040 (7.5 ECTS p1) Theory and methodology of science with applications
- Elective courses (at least 22.5 credits)
- Master thesis

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KTH/Department of mathematics

Detailed information on the courses can be found in our web site. Please, click on the selected subject at https://www.kth.se/en/sci/institutioner/math/utb

UCL/Louvain school of engineering

Detailed information on the courses in the field of Applied Mathematics can be found in our web site:

http://www.uclouvain.be/en-prog-map2m

This Annex has been signed in two originals in English, of which each institution has taken one.

Dual Master in Mathematical Engineering