

Descriptions, explanations and expectations of the KIMP_DM Master of Science

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3rd October 2022

ARTS ET MÉTIERS IN FIGURES

11 SITES all around France dedicated to research and teaching	220 Contraction of the second	1 BACHELOR IN TECHNOLOGY
6200 STUDENTS all programs combined	15 LABORATORIES and research teams	11 = ENGINEERING PROGRAMS
1100 STAFF teaching, research, technical & administrative	7 MILLIONS EDUCATION	+20 A MASTER OF SCIENCE
15 _{MILLIONS} E in revenues generated by contracts with industry	2000 STUDENTS in continuous education programs	17 SPECIALIZED MASTERS ©



ARTS ET MÉTIERS A UNIQUE NETWORK

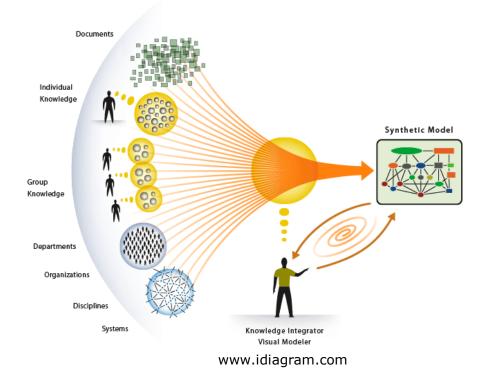


K.I.M.P. KNOWLEDGE INTEGRATION

Why Knowledge Integration ?!

The aim of Design is to manage (during creative and decision phases) all constraints, Knowledge and information involved on both the Product to design and its manufacturing process.

With this global view, the goal is to design **not a local good solution** (the best if we consider only one expertise) **but the global one** (the best compromise).





KIMP TRACKS 3 TRACKS, 3 CAMPUSES, 1 GOAL

The international Master of Science KIMP is proposed in three Arts et Métiers campuses. Each of them proposes a specific track :



Agile Production System - Adel OLABI To be able to design and integrate agile (flexible and rapid) production systems for modern and competitive production industries

CII (Integrated Design and Innovation) - Ali SIADAT To be able to manage production systems by modeling them, their products, company and resources. Courses taught **in French**.

Design and **M**anufacturing - Alain ETIENNE To be able to apply integrated design

To be able to apply integrated design and manufacturing, concurrent engineering, computer aided design, computer aided manufacturing and computer aided engineering concepts

... but 4 scientific modules (core courses) are common to these 3 tracks.



KIMP DOUBLE DEGREES

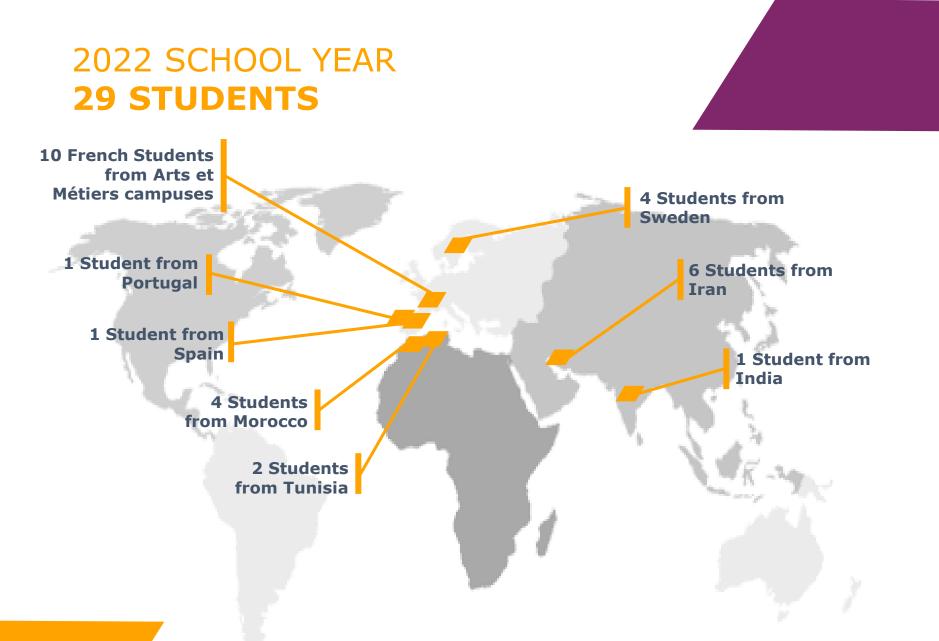


Thanks to the teaching language, KIMP MSc. eases the international relationships through double degree programs with:

- **Swedish** Universities (KTH)
- **German** University Karlsruhe In Technology
- **Danish** University DTU
- North Africa Schools of Engineering (Morocco, Tunisia)
- **Iranian** University (University of Tehran + Iran University of Science and Technology, Sharif University of technology and others in perspectives)

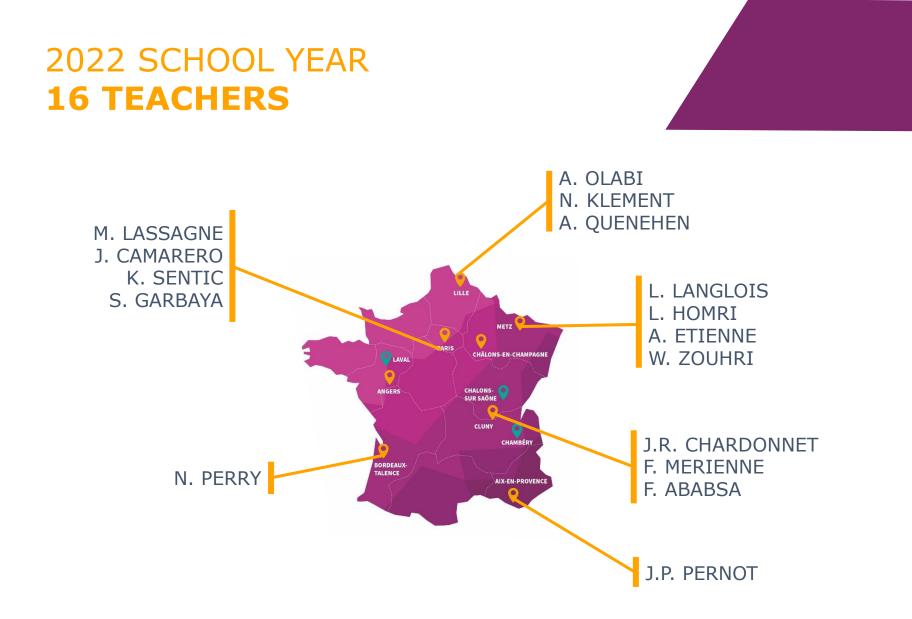
... and several exchanges through ERAMUS and Campus France programs





=> Enjoy all these **cultures to share** and avoid staying in national groups !

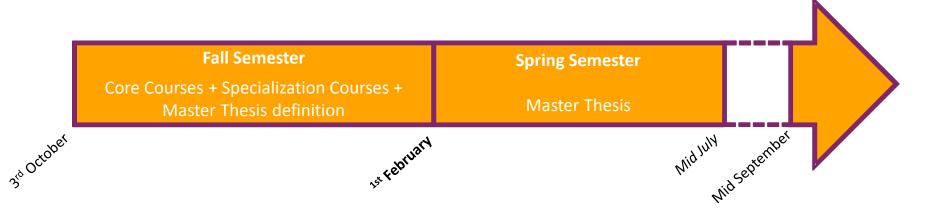




=> They make long trips to teach KIMP courses, **avoid being late**...



2022 SCHOOL YEAR COURSES TIMELINE



The Master year is divided into two main semesters:

- ✓ The Fall Semester (from October to start of February) is dedicated to courses, which are split into 3 main categories:
 - Scientific courses
 - Professional courses
 - Culture and language courses and ATHENS Program
- ✓ The Spring Semester is dedicated to the Master Thesis. It ends with the Master Thesis defense. You have the choice between two defense dates.



Fall Semester

Courses, Schedule, Terms...



FALL SEMESTER CORE COURSES

The first quarter is composed by courses common to all KIMP tracks:

✓ Scientific courses (core courses):

- ✓ UE1 Methods, models for the integration of both
 product and manufacturing process parameters

 L. LANGLOIS
- VE2 Tools for integration Rules based approach from AI
- **UE3** Modeling and control of mechatronics devices
- **UE4** Manufacturing process management

✓ Professional course:

UE5 - Literature Review

✓ Culture and Languages courses:

- **UEL** French language and culture
- UEL English language class for French native speakers



A. ETIENNE

A. OLABI

N. KLEMENT A. QUENEHEN

S. GARBAYA

K. SENTIC

J. CAMARERO

FALL SEMESTER SPECIALIZATION COURSES

The second quarter is composed by courses specific to each track. KIMP_DM track specialization courses are:

✓ Scientific courses:

 UE21 - Sustainable engineering 	}	N. PERRY
 UE22 - Robust Design and Big Data 	}	L. HOMRI W. ZOUHRI
 UE23 - Geometrical product representation for CAD and CAM 	}	J.P. PERNOT
 UE24 - Digital mock-up and virtual environments 	}	J.R. CHARDONNET S. GARBAYA F. MERIENNE
✓ Professional course (shared):		
UE25 - Decision and risk analysis	}	M. LASSAGNE

- ✓ Master Thesis Proposal definition
- ✓ ATHENS Program: No KIMP course planned to help student to participate to this program which is mandatory !





FALL SEMESTER COMMON TERMS

Each module is evaluated by its teachers.

They are totally **free** to choose the way to evaluate you and the number of assessments needed. Evaluation can be oral defenses, reports, projects, exams...

The learning outcomes sheets detail the terms of each course and their objectives.

Penalties can be applied if you don't respect deadlines, terms or if your work is not personal (plagiarism, copy/paste...).



FALL SEMESTER COURSES ORGANISATION

The COVID and previous confinement impacted the manner the courses were taught. The choice was given to the teachers (who came across France and prefer splitting their course on shorter sessions) to organize their course in the manner they consider the best.

The course can be taught:

- ✓ 80% Face to face session in campus Arts et Métiers of Paris
- ✓ 20% Synchronous remote manner: <u>TEAMS video-conference</u> system
- ✓ Asynchronous remote manner: Moodle system (called SAVOIR in Arts et Métiers) => All the KIMP structure is available in this webpage. Since this structure is new, they will be complete in time.

FALL SEMESTER SCHEDULE V2022.1.2



		MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY
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5	m					
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	10-oct au 14-oct 17-oct	A. ETENNE UE2 TEAMS D	M. LASSAGNE UE2.5	L LANGLOIS UE1 UES	A.OLABI UE3 TEAMS	L CAMARERO - FLE
	17-oct au 21-oct 24-oct	A. ETIENNE UE2	CHARDONNETJ.R. ABABSA F. UE24 UE24	N. KLEMENT N. KLEMENT UE4 UE4	A.OLABIUES TEAMS UE2.5	L, CAMARERO-FLE
	au 28-oct 31-oct			L LANGLOIS UE1		
	au 04-nov.	A. ETIENNE UE2 TEAM	Not working day	F. MERIENNE S. GARBAYA UE24 UE5	L. LANGLOIS UE1 Test TEAMS UE3	L CAMADERO- RE
	07-nov. au 11-nov.	A ETIENNE UEZ TEAM	N. KLEMENT N. KLEMENT UE4 UE4		L LANGLOIS UEL TEAMS	Not working day
	14-nov. au 18-nov.			ATHENS Program		
	21-nov. au 25-nov.	Test UE4	Forum Arts & Métiers	NPERRY NPERRY UE 21 UE 21	NPERRY NPERRY M. LASSAGNE UE 21 UE 21 UE 25	K SPUTC - Forlish
	28-nov. au 02-déc.			JP.PERNOT JP.PERNOT UE 23 UE 23	NPERRY NPERRY M. LASSAGNE UE 21 TEAMS UE 21 TEAM T UE 25	K. SENTC - English Test J. CAMARERO - RE
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	12-déc. au 16-déc.	L HOMRI UE22 TEAMS	L HOMRI UE22 TEAMS	JP. PERNOT JP. PERNOT UE 23 UE 23	M. LASSAGNE UE25	
	19-déc. au 23-déc. 26-déc. au		· · · · · · · · · · · · · · · · · · ·	Christmas Holidays		
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	23-janv. au 27-janv.	W.20UHRI UE22 UE22	S. GARBAYA UE24			
	30-janv. au 03-févr.					

All tests are not yet planned => They'll be proposed all along the semester

The up-to-date version (with the classroom) is available in schedule Website : <u>https://lise.ensam.eu</u> by selecting "*Mon planning*". The planning is available when your registration is complete.

FALL SEMESTER EVALUATIONS & VALIDATION



The validation rules are:

- \checkmark For scientific modules:
 - ✓ Each scientific module must be <u>greater than 10</u>: there is no compensation mechanism
 - For ranking, the semester mark considers only scientific courses weighted by their ECTS credits.
- ✓ For professional (and language) modules:
 - ✓ Each professional module must be greater than 10. These marks are not considered in the scientific average (nor in the ranking)
 - ✓ For ATHENS program the ECTS grade must be greater than D : A, B, C, D, E, F

During the second semester, revalidation works are proposed: don't spoil this second chance, there is no third one...

Only the first attempt is considered for both year average and ranking.



Spring Semester

Master Thesis – Definition, Proposal, Schedule



SPRING SEMESTER MASTER THESIS - DEFINITION



Consequently, a master thesis...

- is not a company placements, nor job-shadowing...
- is not compatible with multiple missions' projects (be careful with consulting companies)...
- cannot be **only an application** of well-known technics or methodologies (even on a new case or new product)
- + is defined with a scientific issue
- + is supported by a set of scientific references (articles, conferences...)
- + aims at enriching the scientific community (personal contribution and novelty)





SPRING SEMESTER MASTER THESIS - TERMS

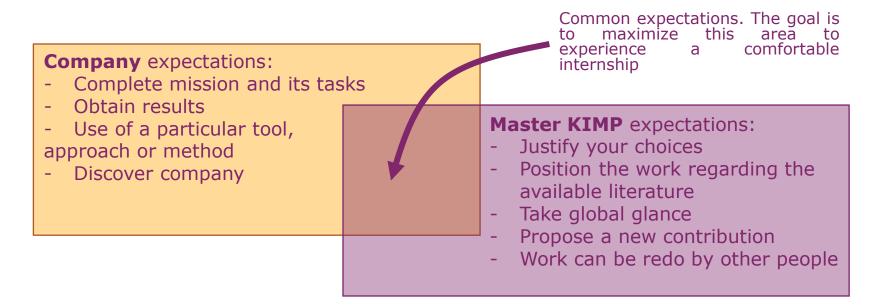
A KIMP Master Thesis...

- ✓ takes at least 4 consecutive months
- ✓ can be performed in a Laboratory (of Arts et Métiers ones or not) or in a Company (mainly in R&D departments French or not).
- ✓ cannot be performed in a student room... The aim is to discover and participate to research and professional lives!
- ✓ is directed and supported by at least an ENSAM Associate Professor (or full professor). I select them regarding the topics of your Master Thesis (that takes time to make a match).
- can be performed not necessary in the city of your 1st semester => take this into consideration for any subscriptions



MASTER THESIS

If you plan to make your Master Thesis in a company, who may consider that their expectations can differ from the ones of a Master Thesis:

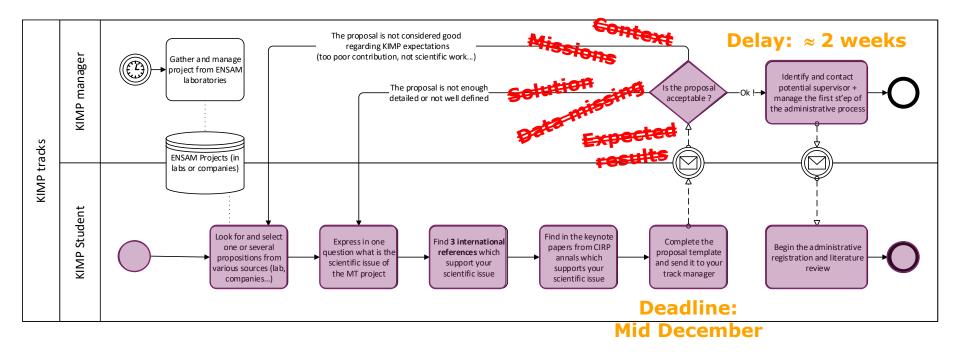


The goal of the proposal is **to check** that the **work expected by the company is not too far** from the one needed to validate a **Master Thesis** work!



MASTER THESIS PROPOSAL'S PROCESS

Before working at full time on your Master thesis project, you have firstly to define it by underlining **what is the scientific issue you try to solve**. To do so, this process must be followed:



The sooner is the better !



MASTER THESIS PROPOSAL - CONTENT

Fulfil all the data required (a template is available on the website) and mail them to me.

- Global information
 - Student's name
 - > Title of the research project
 - Company or Laboratory
 - Information of your future supervisor in the company/laboratory (First name, last name, email address, City and country where the project will be performed...)

Scientific and Problem definition:

- Scientific issue (problematic) written <u>as a question</u>
- Domains of this project and related keywords
- <u>3 Articles</u> related to the scientific issue (not the domain of this project, but linked to the problem you aim to solve)
- > <u>1 Article of the Annals of CIRP</u> related to your problematic
- For each article justify the reason why you selected it and how it is useful for your work.
- Expected contributions (methodology, tool, new approach...)

You can add to this proposal the project statement proposed by the company or the laboratory. If this project is one of them proposed by KIMP Master, you don't have to write any thesis proposal.



 Master-Thesis-Proposal—Title-of 	
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1.→ Global information ¶	
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Title-of-the-research-projectX	×
Laboratory:name#	X
Information- about- the- future-	×
supervisor in the laboratory	
City-and-country-where-the-project-	8
will-be-performed¤ KIMP-tracks-concerned¤	8
Constraints- (language, nationality-	
or-more-specific_)¤	*
Period-of-the-Master-Project#	×
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Keywords-(a-selection-of-3-maximum):	
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validation of your MT

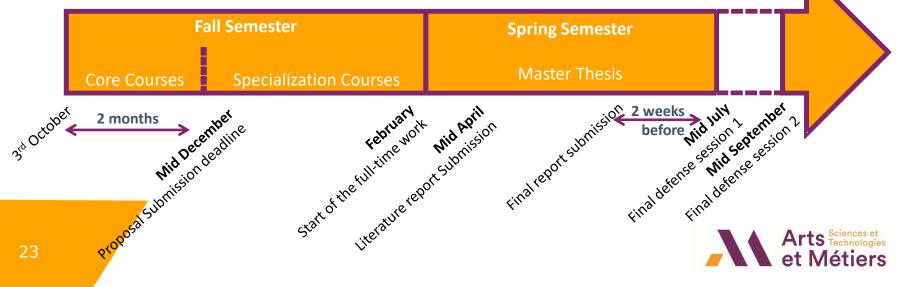
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MASTER THESIS SCHEDULE AND MILESTONES

The work performed during the Master Thesis is evaluated by:

- ✓ The literature review 6 ECTS
 - ✓ A report assessed by your supervisor
- ✓ The Master Thesis works 24 ECTS
 - ✓ A final report assessed by a reviewer who is not your supervisor
 - ✓ A **final defense**, in front of a jury composed by at least three professors
 - ✓ An evaluation of the **work** carried out during the project, by your supervisors

The Master Thesis timeline can be sum up as:



MASTER THESIS EVALUATION CRITERIA

The Master Thesis evaluation is performed by a set of public criteria gathered into an Excel sheet.

This table is easily available for students who wants to know exactly what are the criteria used to evaluate their Master Thesis. In addition, this help you to know what are the expectation of a Master Thesis.

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MASTER THESIS FINAL REPORT

MSc. KIMP Design and Manufacturing Annals - (2020)

KIMP Design and Manufacturing Annals

Data-Driven Tolerance Allocation: a new approach based on Decision Tree and Monte Carlo simulation

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Nowsdays, regarding the growth of manufacturing tachnology, data stores and produces more in the manufacturing processes. Machine learning algorithms plays an essential role in manufacturing changes in manufacturing natures' changes to become more available in the manufacturing processes. The degine network with a devence Meroverve, product quality and manufacturing cost would become more evoid in the manufacturing processes. The degine network with the degine network with the manufacturing processes. The degine network with the degine networ help the meanufacturer produce a qualitative and coaleses product when tolerance allocation gets attention. The manufacturer considers loose tolerances to reduce cost, but designers prefer tight tolerances for a high-quality product. In this paper, machine learning knowledge is considered to deal with tulerance allocation. Therefore, a new approach based on the decision tree technique and Monte Carlo simulation is proposed and toes with contracte anotation, interference, a new approach cased on the decision the decision device carlo s en applied to a Jansen case study. Tolerance Allocation, Tolerance Analysis, Machine Learning, Deep Learning, Monte Carlo, Design, Quality in Manufacturing.

1. Introduction

With the advancement of technology in production, the details can be examined to increase quality and functionality. Increasing competition between large industries and maintaining quality with scraps in production and consumption becomes significant, leading manufacturers to avoid warranty returns [1]. Also, data are easily generated and stored to be used for quality review and

Increasing productivity through technology advancement. To balance quality and cost, the designing process could be considered as an essential issue. The quality level of a part would be satisfied due to the haphezard part deviations' limit, designers specify and allocate tolerances to consider those limits [2]. The tolerancing process can profoundly impact the quality, the cost of the product, and the scrap rate. Designers want tight tolerances to assure product performance; manufacturers prefer loose tolerances to reduce cost. Tolerance design in the design stage can provide a prediction about product quality [1]. Tolerance Specification, Tolerance Allocation, Tolerance Synthesis, and Tolerance Analysis are four different tasks to be considered [2]. Assigning and distributing the tolerance values is a simple definition of tolerance allocation [2]. Therefore, tolerance allocation would be critical to balance cost and quality due to increased product functionality and profitability [2, 3]. To estimate the quality of the tolerance allocation phase, tolerance analysis would be determined [1]. Tolerance analysis corresponds to calculating the probability of having the defect in the assembly processes. Tolerance synthesis aims to find the most relevant tolerances and re-allocate the analyzed tolerances for each part, which helps tolerance allocation obtain the required quality [4]. In 2. Statistical tolerance analysis - a short review the tolerance analysis phase, components are known for the model, and tolerance analysis aims to assess assembly tolerance. In the tolerance allocation, assembly features and tolerances are known for the model and the component's tolerances are calculated [5]. Figure 3 (a) illustrated the difference between tolerance analysis and allocation.



Therefore, the design tolerance process can be defined as a sequence of instructions containing tolerance allocation, tolerance analysis, and tolerance synthesis. As mentioned before, due to technology's progress, outcome

data for each manufacturing process would be stored more. Using this data would be able to predict product features as a design feature. In this article, the new approach extracts rules from the decision tree result to identify new tolerances. This approach helps to solve non-linear and complex problems. Section 2 describes a short review of tolerance analysis and discusses three main issues In tolerance analysis, Section 3 demonstrates tolerance allocation's role and reviews the current approach in tolerance allocation. The problem statement has been considered in section 4. In this section new approach has been proposed and compared with the current approaches. Section 5 talks about research methodology and clarifies the main contribution of this article. Also, a brief review of the machine learning tasks has been contemplated. Section 6 brings a JANSEN linkage case study and applies the methodology to the case. Then, in this section, results are demonstrated and show that the article's methodology applies to non-linear and complex problems. Finally, section 7 gives a conclusion about this article.

Generally, tolerance makes the manufacturer ensure that the Generally, concreases makes the manufacturer ensure that the assembly process's functionality is proper by studying the defect probability of variations in the part's genometry and positioning [3, 6]. There are two procedures to apply tolerance analysis: the worst-case and statistical tolerance analysis [3, 7, 6]. The worst-case method considers the worst possible tolerances. Initially and tries to optimize and examine based on these tolerances. Itcain lead to unrealistic results, notwithstanding the unrealistic and

The final report of Master Thesis is now written as a conference article (about 6 pages, double column, the format is provided).

The goal is to have a first experience of article writing that is a key activity of the researchers and to ease the valorization of the scientific work performed during the semester.

In 2020, 3 students' articles were selected and published in international conferences.



MASTER THESIS EXAMPLES - CLASS 2021-22

Several topics, in several domains (Design and Eco-design, Control, Management, Manufacturing, Supply Chain, aerospace, automotive, IT...):

- ✓ Decarbonization of the supply for the Europe area
- ✓ Developing knowledge and new process to introduce bio-composite at Faster
- ✓ Improve global performances of rigid range versus main competitors
- ✓ Production management and Production Pace Control approach
- ✓ Development and evolution of a rapid prototyping machine
- ✓ Dynamic management of reconfiguration manufacturing systems against risks
- ✓ Fair Multi-dose Multi-Vaccine Distribution with Uncertain Demand
- ✓ 3D automatic modelling of assembly lines
- ✓ Uncertainties management for LCA approaches

- ✓ How to valorize the assets of concrete construction systems regarding the use of recycled aggregates and low-carbon concrete
- ✓ Application evaluation of Marthaler's Systematic Approach to Deriving Cross-Generational Systems of Objectives of Future Product Generations through Strategic Foresight on a Startup
- ✓ Sustainable & Integrated Product and Supply Chain Design
- ✓ Measure and Improve the efficiency of the Department of General Assembly.
- ✓ How to capture maintenance tasks and how to design a robot to automate them?
- ✓ Developing knowledge and new process to introduce bio-composite at Faster

These Master Thesis projects was carried out (in 2021-22):

- ✓ In Companies: 73% (some of them were proposed by labs but the position was in a company)
- ✓ In Laboratories (in France or abroad): 27%
- About 30 projects proposed by KIMP program (only 5 selected by KIMP_DM students)



KIMP_DM ECTS CREDITS

60 ECTS (European Credits Transfer System) are allocated:

5	5	Professional courses	6 ECTS	1 ECTS 1 ECTS 2 ECTS 2 ECTS	UE5 – Literature review ATHENS Program UEL – Language and culture UE25 – Decision and risk analysis
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Master o	semester ECTS	Literature Review	6 ECTS		
Z	Spring seme 30 ECTS	Master Thesis	24ECTS		Master Thesis Report Master Thesis Defense Master Thesis Work



KIMP_DM ONLINE RESOURCES



Your **schedule** is available at: <u>https://lise.ensam.eu/</u> Your **mailbox** is available at: <u>https://outlook.office.com/mail/</u> **Check them every day** since it is our only way to send you important information ! Please, from now, use this mailbox to contact me and our teachers. TEAMS meeting invitation will come on your mailbox

A **Moodle webpage, called SAVOIR** is used to store KIMP documents (courses materials, Master Thesis proposals, this presentation...). To access it, use your ENSAM login and password. Its address is : https://savoir.ensam.eu/moodle/course/index.php?categoryid=2181

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ScienceDirect (<u>http://www.sciencedirect.com</u>) is an online database of scientific articles. This website is a good first step for your literature review. Keynote papers of the CIRP Annals (needed for the Master Thesis proposal) are directly reachable by following this link: <u>http://www.sciencedirect.com/science/journal/00078506</u>



FACING ISSUES OR QUESTIONS? **PEOPLE TO CONTACT**

In order to improve your daily life in Paris, to have answers to your questions or to find a solution to your problems, please contact:

- ✓ For registration or administrative issues: Colin DAVRAINVILLE (his office is in the school department area)
- ✓ For exchanges programs, and ATHENS program: Delphine
 LUCHEZ (her office is in the school department area)
- ✓ For KIMP_DM courses, schedule and organization issues: Alain ETIENNE (my office is in Metz ☺). You can contact me directly:
 - ✓ By email: <u>alain.etienne@ensam.eu</u>
 - ✓ By Teams: Send me an email first to plan an appointment.

If you have any doubt about who to contact, please **contact me first**: I will transfer your request to the right people, if need be.



KIMP_DM NEXT STEPS...



Now: *Question and Answers* session if you have ones. We are at your disposal.

This afternoon at 13:30 : First session of 3 hours of module UE2 with me in Classroom C2.

From now (urgent!): Register for ATHENS program (the mail you receive last week) + Complete school registration (see Colin)

From now: Think about your Master Thesis Project : identify what are the topics you want to work in and have a look at companies and laboratories' propositions...



Any Question ?

alain.etienne@ensam.eu





