Course content for International Master program „Mathematical modeling, computation and optimization“

Course name	Computer Algebra
Contents and Objectives	Content: • Basics of abstract and commutative algebra • Monomial orderings • Gröbner bases • Buchbergers algorithm • Elimination theory • Applications: ideal memebership problem, Hilberts Nullstellensatz etc. • Monomial orderings in local rings, Standard bases • Computation of local invariants (e.g. Milnor and Tjurina number) • Further applications to robotics etc. Objectives of the course: The main topic of this course is the theory of Gröbner bases. They provide a generalization of the division with reminder to polynomials in many variables. This has an amazing range of applications from theoretical questions (like a rather elementary proof of Hilbert's Nullstellensatz) to concrete problems involving systems of polynomial equations (e.g. in robotics)
Teaching	This course consists of lectures and exercise classes. • Lecture: Computer algebra (4h/week) • Exercise class: Computer algebra (2h/week)
Prerequisites	Basic notions of Linear Algebra and Analysis
Examination	Oral exam (30 minutes)
Credits	8 ECTS points
Frequency	This course is given at least every second year.
Workload	The estimated total working time for this course is 240 hours.
Duration	This course is given during one semester.