Evolutionary game theory and mean field games

5,0 ECTS  
  
Short description:

The course consists of two related parts which, however, may be taken independently.

The first part deals with the theory of mean field games, which is a mathematical theory for games with a very large number of players. Each player follows a strategy which is optimal given the environment and the strategies of all competitors, while contributing to the environment of all other players. When the number of players is very large, the competitive environment can be well described by certain average properties of the players’ strategies, and the mean field game theory provides means for finding effective equations for these averages. While the mean field game theory has been developed e.g. for models of financial markets, a possible application is for modeling of competition in biological populations.

The second part of the course deals with mathematical models of evolution and speciation, and is more focused on the application of existing mathematical tools (e.g. differential equations, individual-based models) to investigate unresolved questions in evolutionary biology. One such questions is the importance of adaptation and sexual selection when new species are formed.

Location and dates:  
Department of mathematical sciences, Spring semester 2012. The exact location will be announced in the departmental web page.   
The course will be lectured daily May 21-25 and June 18-21. Introductory lectures: Monday May 21, 13.15-15.00, and June 18, 13.15-15.00 respectively.  
  
Aim of the course:  
After finishing the course the participants will understand the basic theory of mean field game theory, and be able to formulate models of games in these terms. The student will also have an up to date knowledge of the mathematical theory, although many proofs lay outside the scope of the course. Completion of the second part of the course will give the student knowledge of the theory of speciation, and in particular of theory concerning sexual selection.

Target group:  
Graduate students in mathematics, mathematical statistics, physics, economics, theoretical biology.

Course organizers:

Torbjörn Lundh ([torbjorn.lundh@chalmers.se](mailto:torbjorn.lundh@chalmers.se)) , Philip Gerlee ([gerlee@chalmers.se](mailto:gerlee@chalmers.se)) and Bernt Wennberg ([wennberg@chalmers.se](mailto:wennberg@chalmers.se))

Teaching staff: Olivier Guéant, Université Paris-Diderot (<http://www.oliviergueant.com/>)  
 Sander van Doorn, Universität Bern (<http://behav.zoology.unibe.ch>)   
  
Lectures: 5+5 double hours

Exam: Hand-in problems.

Literature: Lecture notes and journal articles.  
  
Registration: Please contact the course organizers if you cannot attend the first lecture.