

Applied and Computational Mathematics Graduate Program 2020-21

University of Crete



June 4, 2020

The Program

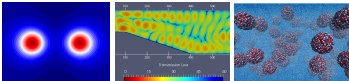
The program (started on 2018) offers the following streams

- Scientific Computing
- Modeling and Analysis in Sciences and Technology
- Statistics and Stochastic Analysis

There are currently 20 graduate students pursuing the MS degree, and 10 PhD candidates.

Website: <http://www.math.uoc.gr/gpacm/>

Πρόγραμμα Μεταπτυχιακών Σπουδών
Εφαρμοσμένα & Υπολογιστικά Μαθηματικά



Τμήμα Μαθηματικών και Εφαρμοσμένων Μαθηματικών
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Γραμματεία ΠΜΣ
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Το ΠΜΣ έχει διάρκεια 4 εδάμηνα και δίνει την δυνατότητα απόκτησης Μεταπτυχιακού Διπλώματος Ειδίκευσης στις εξής ειδικότητες:

- Επιστημονικοί Υπολογισμοί
- Μοντελοποίηση και Ανάλυση στις Επιστήμες και την Τεχνολογία
- Στατιστική και Στοχαστική Ανάλυση

Στο πρόγραμμα γίνονται δεκτοί πτυχιούχοι Θετικών Επιστημών, Πολυτεχνικών και Οικονομικών Σχολών καθώς και πτυχιούχοι άλλων Πανεπιστημιακών Τμημάτων και ΤΕΙ, συναφούς γνωστικού αντικείμενου.

Τα μαθήματα του ΠΜΣ που προγραμματίζεται να δοθούν το έτος 2020-21 είναι: Εφαρμοσμένη Συναρτησιακή Ανάλυση, Μέθοδοι Εφαρμοσμένων Μαθηματικών, Αριθμητική Ανάλυση, Αριθμητική Επίλυση ΔΕ, Μοντελοποίηση, Μαθηματική Θεωρία Γλυκών, Στοχαστικές Ανελίξεις, Στατιστική Συμπερασματολογία και Μηχανική Μάθηση.

Προθεσμία για την υποβολή αιτήσεων: **21 Ιουνίου 2020**

Ενενετείεαι: **Πέμπτη, Παρασκευή, 24-25 Ιουνίου**. Η συνέντευξη αφορά στους στόχους και τα ενδιαφέροντα των υποψηφίων, περιλαμβάνει ερωτήσεις σε θέματα του γνωστικού αντικείμενου του προγράμματος σπουδών, και συζήτηση για τις προοπτικές μετά την απόκτηση του μεταπτυχιακού διπλώματος.

Παροσκόηση του προγράμματος: **Πέμπτη, 4 Ιουνίου 2020, 18.00 (Zoom)**
Πίληρες κείμενο της πρόσκλησης: http://math.uoc.gr/ark/gradPropACM2019-20_est.pdf

* Ο σύνδεσμος για την παρουσίαση θα αναρτηθεί στην ιστοσελίδα www.math.uoc.gr την ίδια ημέρα.

Courses offered

The graduate program offers courses in

- Applied Functional Analysis
- Methods in Applied Mathematics
- Modeling in the Sciences and Technology
- Mathematical Theory of Solids
- Multi-scale Simulations and Statistical Mechanics
- Numerical Analysis
- Numerical Solution of Differential Equations
- Stochastic Processes
- Statistical Inference and Machine Learning
- ...

Students may also enroll on courses in Computer science, Physics, Pure mathematics, etc.

Project work and Seminars

- **1st year** courses include project work, rather than only lecturing and exercise.
- **2nd year** is mostly devoted to thesis work. Students may also attend more courses, e.g., reading courses.
- **Master thesis** can be carried out also in research institutions (e.g. FORTH) and companies in Europe.
- Short term **seminar series** (one or more weeks) are given by local and visiting staff (Erasmus courses), depending on availability.

Scholarships and Fellowships

There are no tuition fees.

Funding possibilities:

- Fellowship “M. Manasaki” from the University of Crete
- Fellowship “S. Pichoridis” from the Institute of Applied and Computational Mathematics at FORTH
- Scholarships via research projects at the University or at the FORTH research center.

Faculty research directions

The staff associated with the ACM graduate program conduct **research in many areas**, including

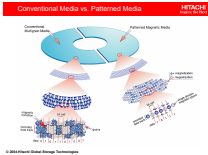
- Modeling in Sciences and Technology
- Numerical Solution of Differential Equations
- Applied Differential Equations
- Stochastic Processes and Applied Statistics

The graduate program is in close collaboration with the Institute of Applied and Computational Mathematics at Foundation of Research and Technology - Hellas (**IACM/FORTH**).

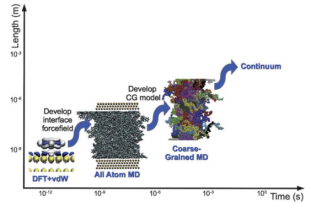


Outward looking

Magnetic recording

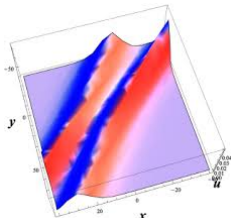


Complex systems

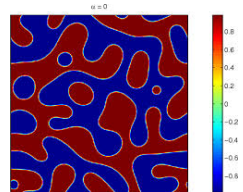


Applied and Computational Mathematics

Waves in optics

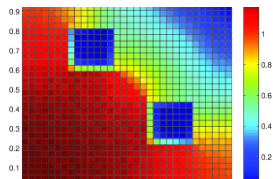
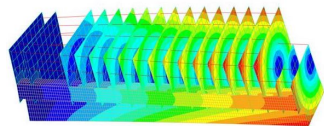
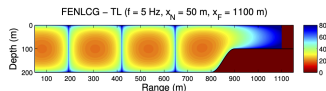


Phase separation



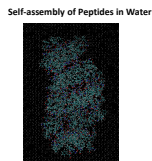
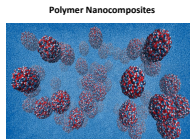
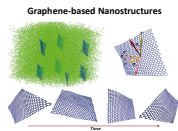
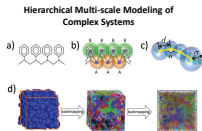
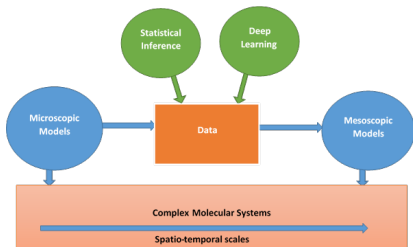
Numerical Analysis

- Numerical methods for **deterministic** and **stochastic** differential equations
- **Adaptive algorithms** for computational fluid dynamics, conservation laws, wave propagation
- Evolution equations, **adaptive algorithms for nonlinear PDE's** and for **models across scales**
- Finite element and volume methods



Molecular Modeling and AI Technologies

- Multi-scale methodologies and simulations for molecular systems
- High performance computing (HPC) and Deep learning methods
- Data-driven statistical inference methods for predicting structure-properties relations
- "In silico" (virtual design) of advanced materials



Mathematical Modeling of photoVoltaic(PV) systems

- Model the operation and power output of PV systems
- Mathematical model depending on the solar cell architecture
- System of nonlinear PDE's
- Numerical solution of the mathematical model
- Simulations vs experiments →
- Use **Machine Learning** to estimate unknown operational parameters of solar cell

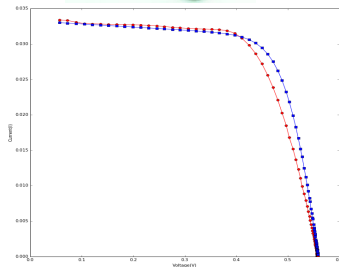
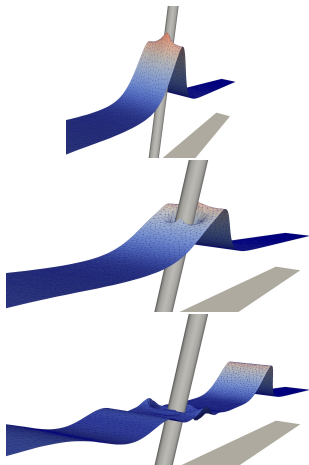


Figure: Red: Experiment,
Blue: Simulation

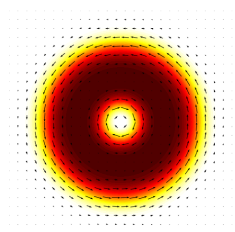
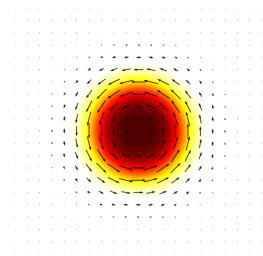
Mathematical Modeling of surface water waves

- Propagation of water surface wave
- Basic principles: conservation of mass and momentum
- Numerical solution of the mathematical model
- Simulations: solitary wave propagation and interaction with objects
- Generation, Propagation of Tsunamis



Solitons in condensed matter

- Nonlinear partial differential equations often govern the **microstructure** in materials.
- Construct or modify a model.
- Connect to topology, PDEs, etc.
- Solutions (solitons) and properties (conservation laws).



Dynamics of microstructure (animation)

Prospects

Research work towards a PhD degree in Greece or in other countries (Germany, U.K., etc.)

- on Mathematics
- on Sciences or Engineering

Work in industry, SMEs on

- scientific computing, HPC
- data analytics
- consulting
- software development
- ...