

Xiong Ding

PH.D. STUDENT · PHYSICS RESEARCHER

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Education

Georgia Institute of Technology

Atlanta, GA, USA

Ph.D. in Physics

Aug. 2012 – Jun 2017

- adviser: Prof. Predrag Cvitanović
- Research area : cycle expansion theory in nonlinear dynamics and soliton explosion in cubic quintic Ginzburg-Landau equation

Georgia Institute of Technology

Atlanta, GA, USA

M.S. in Computer Science & Engineering

Jan.2016 – Jun. 2016

- Interested area : High Performance Computing
- GPA: 3.86/4.0

Skills

Programming : **Proficient :** C/C++, Python, Matlab; **Familiar :** Java, Fortran

Tools : Bash, Perl, Awk, Latex

Libraries : Boost.Python, Eigen, LAPACK, ARPACK, OpenMPI, FFTW, HDF5

Web : Django with Python, CSS, HTML

Employment & Teaching Experience

Center for Nonlinear Science, School of Physics, Georgia Institute of Technology

Atlanta, GA, USA

Research Assistant

2013 – Present

- Apply cycle expansion theory into high dimensional nonlinear dispersive dynamical systems.
- Numerical algorithm to calculate Floquet vectors with high accuracy.
- Soliton explosion in cubic quintic Ginzburg-Landau equation.

Center for Nonlinear Science, School of Physics, Georgia Institute of Technology

Atlanta, GA, USA

Teaching Assistant

2012 – 2013

- Guide undergraduate students in physical experiments.

Online course : Geometry of chaos

www.chaosbook.org/course1

Teaching Assistant

2015 Spring

- Design Homework for 16 weeks and answer questions on Piazza forum.
- Design and implement online autograder.

Projects

COMPUTER SCIENCE RELATED

Online course : Geometry of Chaos

Atlanta, GA, USA

Project : Online autograder

Sprint 2015

- **main goal :** Auto grade students' online submissions and email back their grades. Also, it provides a straightforward interface for the customer (the course instructor) to view the grades online.
- **Framework :** Django in Python, deployed in Heroku **Repository :** <https://github.com/dingxiong/phys7224>

Course project: Gatech CS6491 Computer Graphics

Atlanta, GA, USA

Project : Triangular Mesh

Fall 2015

- **main goal :** Represent a triangular mesh by **CSX** table, and implement navigating methods on the mesh, such as swing, opposite, left, right and so on. Also 4 interesting problems are defined and solved: **geodesic path**, **Gaussian decay swirl**, **lasso deletion** and **mesh cut**.
- **Toolbox :** Processing **Repository :** <https://github.com/dingxiong/triangularMesh> **Demo :** <https://youtu.be/mWe0YO1bbZ4>

Course project: Gatech CS6210 Advanced Operating System

Atlanta, GA, USA

Project : RPC-Based Proxy Server

Spring 2015

- **main goal :** Build a proxy server by remote procedure call(RPC) and test the performance of four different cache policies : no cache, Least Recent Used (LUR), random, and First in First out (FIFO). RPC framework is provided by **Apache Thrift** library.
- **Language :** C++ **Repository :** <https://github.com/dingxiong/CS6210Project3>

Course project: Gatech CS6290 High Performance Computer Architecture

Atlanta, GA, USA

Project : Cache Design for Four Different Traces

Summer 2014

- **main goal :** Design and implement a parametric cache simulator and use it to design data caches well suited to the SPEC benchmarks. Variables include 2^C bytes of cache size, 2^S blocks with each block 2^{C-S} bytes, storage policies (ST) and replacement policies (R).
- **Language :** C++ **Repository :** <https://github.com/dingxiong/cacheDesign>

PHYSICS RELATED

Center for Nonlinear Science, School of Physics, Georgia Tech

Atlanta, GA, USA

Project : Computation of Floquet vectors in Kuramoto-Sivashinsky system

2013-2014

- **Main result:** The Floquet multipliers of Periodic orbits in high dimensional system usually spans a large orders of magnitudes. The periodic eigendecomposition is the right tool to obtain Floquet spectrum and vectors to high accuracy. See paper[2] for more detail.

Center for Nonlinear Science, School of Physics, Georgia Tech

Atlanta, GA, USA

Project : Investigation of the local dimension of inertial manifolds in chaotic systems

2014-2015

- **Main result:** By studying the shadowing cases of periodic orbits in Kuramoto-Sivashinsky system, we show strong evidence that the inertial manifold has dimension 8. see paper [1] for more details.

Center for Nonlinear Science, School of Physics, Georgia Tech

Atlanta, GA, USA

Project : Symbolic dynamics in symmetry reduced 1-d Kuramoto-Sivashinsky system

2015-PRESENT

- In the symmetry reduced state space, the attractor of 1-d Kuramoto-Sivashinsky system is low dimensional. By constructing appropriate Poincaré section, we propose to obtain the symbolic dynamics.

MATHEMATICS RELATED

School of Mathematics, Georgia Tech

Atlanta, GA, USA

Project : Integration of soliton explosion with local error control in cubic quintic Ginzburg-Landau system

Sprint 2016

- **Adviser :** Prof. Sung Ha Kang
- **Main result:** add time step control into a few popular exponential integrators. See paper [3].

Conferences & Talks

SIAM Conference on Application of Dynamical Systems

Snowbird, Utah, USA

Talk : Periodic Eigendecomposition and Its Application in Nonlinear Dynamics

May 2015

- Coauthor: Prof. P. Cvitanović

Dynamics Days US

Atlanta, GA, USA

Poster : Lyapunov exponents, Floquet exponents and covariant vectors in Kuramoto-Sivashinsky equation

Jan. 2014

- Coauthor: Prof. P. Cvitanović

SIAM Student Chapter Seminar

Atlanta, GA, USA

Talk : Periodic Eigendecomposition and its application in nonlinear dynamics

Sep. 2014

- Coauthor: Prof. P. Cvitanović

Publications

[1] X. Ding, H. Chaté, P. Cvitanović, E. Siminos, and K. A. Takeuchi, *Estimating the dimension of an inertial manifold from unstable periodic orbits*, *Phys. Rev. Lett.* **117**, 024101 (2016)

[2] X. Ding and P. Cvitanović, *Periodic Eigendecomposition and its application in Kuramoto-Sivashinsky system*, *SIAM J. Appl. Dyn. Syst.* **15**, 1434–1454 (2016)

[3] X. Ding and S. H. Kang, *Integration of a cubic-quintic complex Ginzburg-Landau exploding soliton*, *In preparation* (2016)

[4] X. Ding and P. Cvitanović, *Periodic orbit explosion and its symmetry reduced state space visualization*, *In preparation* (2016)

[5] X. Ding and P. Cvitanović, *Symbolic dynamics and analysis of Kuramoto-Sivashinsky attractor*, *In preparation* (2016)