

# 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 : nonlinear dynamics, cycle expansion theory, bifurcation theory, complex 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(HPC), Machine Learning (ML)
- GPA: 3.86/4.0

## Skills

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

**Tools :** Bash, Perl, Unix: Sed & Awk, Latex

**Libraries :** CUDA, Cilk, Boost.Python, Eigen, LAPACK, ARPACK, OpenMP, OpenMPI, FFTW, HDF5

**Web :** Django with Python, CSS, HTML

## Professional Experience

### Online course : Geometry of chaos

[www.chaosbook.org/course1](http://www.chaosbook.org/course1)

Role : Web developer & Teaching Assistant

2015 Spring

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

### Center for Nonlinear Science, Georgia Institute of Technology

Atlanta, GA, USA

Role : Research Assistant Adviser : Prof. Predrag Cvitanović

**Research topic :** 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.

**Research topic :** 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.

**Research topic :** 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.

### School of Mathematics, Georgia Tech

Atlanta, GA, USA

Role : Cooperation with Prof. Sung Ha Kang from Math department

**Research topic :** Integration of soliton explosion with local error control in cubic quintic

Sprint 2016

Ginzburg-Landau system

- **Main result:** Study the performance of exponential integrator in Ginzburg-Landau system, and add time step control into a few popular exponential integrators. See paper [3].

## Selected CS Course Projects

## 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>

## Course project: Gatech CSE6230 High Performance Computing : Tools and Applications

Atlanta, GA, USA

**Project :** CPU and GPU optimization in finding initial condition for Kuramoto Sivashinsky equation

Fall 2013

- **main goal :** CPU and GPU optimization is deployed to find relative good initial conditions for Kuramoto-Sivashinsky equation.
- **result :** Our result shows that the **icc & Cilk** approach has the best performance of all multi CPU implementation, and the GPU implementation has better performance if register usage is considered.
- **Language :** C    **Tools :** gcc, icc, OpenMP, Cilk, CUDA, SIMD(SSE2, SSE4)
- **Repository :** <https://bitbucket.org/dingxiong/project>

## Conferences & Talks

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### 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

## Publications

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- [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)