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, Awk, Latex

Libraries : CUDA, Cilk, Boost.Python, Eigen, LAPACK, ARPACK, OpenMP, 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 dispative dynamical systems.
- Numerical algorithm to calculate Floquet vectors with high accuracy.
- Soliton explosion in cubic quintic Ginzburg-Landau equation.

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 studensts' 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 polices : 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

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

Publications

[1] **X.Ding**, H. Chaté, P. Cvitanovi´c, 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)