

CHRISTINE MICHELLE SZPILKA

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EDUCATION

University of Oklahoma, Norman, Oklahoma, **1998-present**
Ph.D. Civil Engineering, expected July 2003
Grade Point Average: 4.0/4.0

Carroll College, Helena, Montana, **1994-1998**
B.A. Mathematics - Engineering/Physics concentration
Grade Point Average: 3.76/4.0 (Magna Cum Laude)

High-school GED Helena, Montana, **1994**
Carroll College Advanced Placement, **1993-1994**
Cornerstone Academy, **1990-1993**

TEACHING EXPERIENCE

School of Civil Engineering & Environmental Science, University of Oklahoma, **1998-2003**
Graduate Teaching Assistant

Courses taught:

Numerical Methods
(Junior-level class required for most of the engineering majors.)

Responsibilities:

Team taught with my faculty advisor; helped prepare lecture material and lectured half-time. Prepared homework solutions and Readiness Assessment Test (RAT) questions, graded homework assignments and RATs, held office hours and *Mathematica* tutorial sessions. (All in-class and homework exercises required the use of *Mathematica*.)

Courses assisted:

Environmental Engineering I
(Junior-level course required for civil engineering majors, which focuses on water resources from a supply and demand perspective. This course is part of the Sooner City sequence.)

Responsibilities:

Prepared homework solutions for grader, helped prepare RAT questions and graded RATs, developed virtual experiments to be used as in-class group exercises in order to illustrate key points from the lectures, held office hours for homework help, served as substitute teacher as needed.

Water Quality Management

(Senior and graduate-level elective course, which covers water quality issues in rivers, lakes and estuaries from a modeling perspective.)

Prepared homework solutions and helped prepare RAT questions, graded homework assignments and RATs, held office hours for homework help, served as substitute teacher as needed.

Department of Mathematics, Carroll College, **1995-1998**

Undergraduate Teaching Assistant

Duties included grading papers for pre-calculus, calculus and physics.

Academic Resource Center, Carroll College, **1996-1998**

Undergraduate Tutor

Duties included holding drop-in tutorial sessions for mathematics and physics students. Help sessions were offered in remedial math courses, pre-calculus, calculus, engineering calculus courses, statistics, physics and engineering physics.

Saint Andrew's Catholic School, Helena, Montana **1997**

Substitute Teacher

I taught the high-school freshmen algebra class for one week. Duties included preparing lectures in accordance with the regular teacher's lesson plan and assigning homework exercises.

PEDAGOGICAL TRAINING

University of Oklahoma, Instructional Development Program (IDP)

Faculty Discussion Groups

"Changing Nature of Higher Education", **Spring 1999**

Weekly seminar of round-table discussions addressing new pedagogical frameworks for higher education, such as distance learning and cooperative learning.

RESEARCH EXPERIENCE

University of Oklahoma, **1998 - present**

Graduate Research Assistant

My dissertation work focused on algorithm development for modeling with the shallow water equations (SWE). This system of equations is derived from the depth-averaged Navier-Stokes equations, utilizing a hydrostatic pressure assumption and is valid for modeling applications where the depth of water is much less than the lengths of horizontal processes, hence the name "shallow water." (These assumptions are true for most flows in the ocean.) My work is split into two main categories: mathematical analysis of new spatial discretizations using one-dimensional case studies, and the coupling of a transport model with the 3D production code, ADCIRC (ADvanced CIRCulation model for three-dimensional flows). For the one-dimensional case studies, I examined two discontinuous discretization methods that have recently been applied to SWE modeling, the finite volume method and the discontinuous Galerkin finite element method, and compared them with well-known solution algorithms. I utilized Fourier analysis techniques and developed a numerical analog of these techniques in order to study the propagation behavior of the discontinuous methods, which cannot be easily studied analytically. I also studied the properties and feasibility of coupled solution techniques, whereby different discretization algorithms could be used in subdomains of the model problem in order to capitalize on the best features of each algorithm. I am currently beginning the transport model portion of my research and hope to develop a simplified two-dimensional model in order to gain insight into the 3D processes. This work will result in the submission of three peer-reviewed journal papers.

I also worked on a groundwater modeling project in cooperation with another Ph.D. student and faculty member. For this project I improved the model physics of an existing groundwater model by including biodegradation processes. This required examining the boundary conditions of the sorption model and the relative time scales of the three physical processes being modeled - non-linear sorption, biodegradation, and intraparticle diffusion. After several iterations we decided to use an explicit boundary condition to couple the three processes. This work resulted in a journal publication and a comment paper.

University of Oklahoma, **Summer 1997**

National Science Foundation (NSF) - Research Experience for Undergraduates

I worked with R.L. Kolar on a research project undertaken at the closed Norman, Oklahoma landfill, which was designated as a research site for the USGS's toxic substances hydrology program in 1994.

The research topic was to explore multiple models for computing estimates of evapotranspiration (ET) based on half-hourly meteorological data in order to determine an accurate but cost-effective model, which would then be incorporated into a larger groundwater infiltration model. To fulfill this requirement, I ran spreadsheet simulations of seven ET models and compared the results with regional pan evaporation measurements. I presented the results of my study at the Annual American Geophysical Union Hydrology Days conference in April of 1998. This research also became the topic of my senior honors project at Carroll College and resulted in a thesis for honors recognition.

ACADEMIC AWARDS

NSF Graduate Research Fellow, 1999-2001, 2002-2003

Alumni Graduate Fellow, University of Oklahoma, 1998-2002

Alfred J. Murray Award for a Senior Demonstrating Excellence in Mathematics, Carroll College, 1998

Freshmen Award for Excellence in Mathematics, Carroll College, 1995

Dean's List - five semesters, Carroll College

PUBLICATIONS

C.M. Szpilka and R.L. Kolar. "Numerical analogs to Fourier and dispersion analysis: development, verification and application to the shallow water equations," *Advances in Water Resources*, **26**: 649-662, 2003.

C.M. Gossard and R.L. Kolar. "Wave propagation characteristics of continuous and discontinuous Galerkin finite element algorithms for the shallow water equations," *Proceedings of the XIV International Conference on Computational Methods in Water Resources*, Delft, The Netherlands. Hassanizadeh et al. (eds), Elsevier: 1621-1627, 2002.

H.K. Karapanagioti, C.M. Gossard, K.A. Strevett, R.L. Kolar and D.A. Sabatini. "Reply to comment on 'Model coupling intraparticle diffusion/sorption, nonlinear sorption, and biodegradation processes' by H. Basagaoglu, T.R. Ginn, and B.J. McCoy," *J. Contaminant Hydrology*, **57**: 311-317, 2002.

H.K. Karapanagioti, C.M. Gossard, K.A. Strevett, R.L. Kolar and D.A. Sabatini. "Model coupling intraparticle diffusion/sorption, nonlinear sorption, and biodegradation processes," *J. Contaminant Hydrology*, **48**: 1-21, 2001.

C.M. Gossard and R.L. Kolar. "Phase behavior of a finite volume shallow water algorithm," *Proceedings of the XIII International Conference on Computational Methods in Water Resources*, Calgary, Canada. Bentley et al. (eds): 921-928, 2000.

C.M. Gossard, M. Hornecker and R.L. Kolar. "Evapotranspiration estimates for the closed Norman, Oklahoma landfill," *Proceedings of the Eighteenth Annual American Geophysical Union Hydrology Days Conference*, Ft. Collins, CO, H.J. Morel-Seytoux (eds): 111-120, 1998.

CONFERENCE PRESENTATIONS

American Society for Engineering Education (ASEE) Regional Meeting, Manhattan, KS

2001 "RATs: A student/instructor perspective"

International Conference on Computational Methods in Water Resources (CMWR)

2002 [Delft, The Netherlands] "Wave propagation characteristics of continuous and discontinuous Galerkin finite element algorithms for the shallow water equations"

2000 [Calgary, AB, Canada] "Phase behavior of a finite volume shallow water algorithm"

ADvanced CIRCulation (ADCIRC) Model Workshop, Stennis, MS

2003 "Propagation behavior of coupled continuous/discontinuous Galerkin FE approximations to the SWE"

2002 "DG for dummies (like me): Background and a step-by-step 'recipe' for the Discontinuous

Galerkin FE algorithm as applied to the linearized SWE”

2002 “Wave propagation characteristics of continuous and discontinuous Galerkin FE algorithms for the shallow water equations”

2001 “A numerical analogue to Fourier analysis”

2000 “Phase behavior of a finite volume SWE algorithm”

Society for Industrial and Applied Mathematics (SIAM), Austin TX

2003 “Propagation behavior of coupled continuous/discontinuous Galerkin algorithms for the shallow water equations”

American Geophysical Union Hydrology Days, Fort Collins, CO

1998 “Evapotranspiration estimates for the closed Norman, Oklahoma landfill”

OTHER CONFERENCES ATTENDED

American Society for Engineering Education (ASEE)

2002 Regional, Norman, OK

2001 National, Albuquerque, NM

2000 National, St. Louis, MO

1999 National, Charlotte, NC

1999 Regional, Stillwater, OK

International Conference on Estuarine and Coastal Modeling (ECM)

2001, St. Petersburg, FL

2000, New Orleans, LA

PROFESSIONAL ORGANIZATIONS

American Society for Engineering Education (ASEE): student member

American Society for Civil Engineering (ASCE): student member

COMMUNITY SERVICE ACTIVITIES

Saint Joseph Catholic Church, Norman, OK, 2001-2003

Lector

Rite of Christian Initiation for Adults (RCIA) Facilitator and sponsor

Circle K student service club, Carroll College, 1994-1995