BIOGRAPHICAL SKETCH

XIANGSHENG XU
LAST UPDATED: 01/04/2021

(a) Professional Preparation:

Nanjing University, Nanjing, China, Mathematics, B.S. 1982
University of Texas at Austin, Mathematics, Ph.D. 1988

(b) Appointments:

08/2015 – 12/2015	Senior Research Scientist	Duke University
08/2002 – 12/2002	Visiting Professor	Rutgers University, New Brunwick
2000 – present	Full Professor	Mississippi State University
1995 – 2000	Associate Professor	Mississippi State University
01/1998 – 06/1998	Visiting Associate Professor	Northwestern University
1990 – 1995	Assistant Professor	University of Arkansas, Fayetteville
1988 – 1990	Visiting Assistant Professor	Texas A&M University
1986 – 1988	Assistant Instructor	University of Texas at Austin
1984 – 1986	Teaching Assistant	University of Texas at Austin

(c) Ten most recent publications:

(1) " Regularity Results for a Nonlinear Elliptic-Parabolic System with Oscillating Coefficients", *Anal. Theory Appl.*, to appear. arXiv:1911.05863 [math.AP]
(2) "Nonlinear diffusion in the Keller-Segel model of parabolic-parabolic type", *J. Differential Equations*, **276**(2021), 264-286. arXiv:2007.11883 [math.AP].
(3) " Global existence theorem for a model governing the motion of two cell populations", with Brock C. Price, *Kinet. Relat. Models*, **13**(2020), 1175-1191. arXiv:2004.05939 [math.AP]
(4) " A class of functional inequalities and their applications to fourth-order nonlinear parabolic equations", with Jian-Guo Liu, *Commun. Math. Sci.*, **18**(2020), 1911–1948. arXiv:2019.1706.06057[math.AP]
(5) "Mathematical validation of a continuum model for relaxation of interacting steps in crystal surfaces in 2 space dimensions", *Calc. Var. Partial Differ. Equ.*, 59:158(2020), 25 pages. arXiv:1910.11153 [math.AP]
(6) "Global existence of strong solutions to a biological network formulation model in $2+1$ dimensions", *Discrete Contin. Dyn. Syst. Ser. A*, **40**(2020), 6289-6307. arXiv:1911.01970v2 [math.AP]
(7) "Partial regularity of weak solutions and life-span of smooth solutions to a biological network formulation model", *SN Partial Differ. Equ. Appl.*, 1:18(2020), 31 pages.
(8) "Global existence of strong solutions to a groundwater flow problem", *Z. Angew. Math. Phys.*, 71:127 (2020), 29 pages. https://doi.org/10.1007/s00033-020-01352-2.
(9) "Logarithmic upper bounds for weak solutions to a class of parabolic equations", *Proc. Roy. Soc. Edinburgh Sect. A*, **149**(2019), no. 6, 1481-1491.
(10) "Special solutions to a fourth-order nonlinear parabolic equation in non-divergence form", *Commun. Math. Sci.*, **17**(2019), 817-833.

(d) Ten additional publications:

(1) "Existence theorems for a crystal surface model involving the p-Laplace operator", *SIAM J. Math. Anal.*, **50**(2018), no. 4, 4261-4281.
(2) "Maximal monotone operator theory and its applications to thin film equation in epitaxial growth on vicinal surface", with Yuan Gao, Jian-Guo Liu, and Xin Yang Lu, *Calc. Var. Partial Differ. Equ.*, **57**(2018), no. 2, Art. 55, 21 pp..

(3) "On the initial-boundary-value problem for $u_t - \mathrm{d}iv(|\nabla u|^{p-2}\nabla u) = 0$", *Arch. Rational Mech. Anal.*, **127**(1994), 319-335.
(4) "Partial regularity of solutions to a class of degenerate systems", *Trans. Amer. Math. Soc.*, **349**(1997), 1973-1992.
(5) "On the effects of thermal degeneracy in the thermistor problem", *SIAM J. Math. Anal.*, **35**(2003), 1081-1098.
(6) "Existence of capacity solutions to the problem of In Situ Vitrification", with R. F. Gariepy and M.Shillor, *European J. Appl. Math.*, **9**(1998), 543-559.
(7) "Existence of a solution to the Stefan problem with Joule's heating", with P. Shi and M. Shillor, *J. Differential Equations*, **105**(1993), 239-263.
(8) "A p-Laplacian problem in L^1 with nonlinear boundary conditions", *Commun. Partial Differential Equations*, **19**(1994), 143-176.
(9) " The Stefan problem with convection and Joule's heating", with M. Shillor, *Advances in Differential Equations*, **2**(1997), 667-691.
(10) "A strongly degenerate system involving an equation of parabolic type and an equation of elliptic type", *Commun. Partial Differential Equations*, **18**(1993), 199-213.

(e) Research and teaching grants:

(1) The Herb Handley Research Award, $ 2,000.00, Mississippi State University, 2011.
(2) NSF research grant DMS-9803236, *Mathematical theories of the thermistor problem,* July 1, 1998-June 30, 2001, $54,192.00.
(3) NSF research grant DMS-9424448, *On a class of degenerate systems arising from the electrical heating of conductors*, June 1, 1995-May 31, 1997, $ 30,000.00.
(4) The Teaching Grant Program, University of Arkansas, Spring Semester, 1995, $2,000.00.
(5) NSF special projects grant DMS-9314082, *Mathematical study of nonlinear materials* , with I. Monroe as co-principal investigator, Mar. 15, 1994-Apr. 15, 1994, $8,000.00.
(6) Arkansas Science and Technology Authority (basic research grant 94-B-18), *Existence and fine properties of solutions to problems arising in the study of electrical heating of a conductor*, Sept. 30, 1993-Oct. 30, 1994, $11,551.00.
(7) NSF research grant DMS-9101382, *Some existence problems arising in the study of systems of nonlinear degenerate partial differential equations of elliptic- parabolic type*, June 1, 1991-Nov. 30, 1993, $ 34,075.00.

(f) My current research interest:

My current research deals with analytical validation of various types of partial differential equation models that arise from industrial, engineering, and biological applications. For it to be valid, a mathematical model must have a physically meaningful solution, and we concern ourselves with the existence of such a solution. The existence assertion usually involves three steps:

1. a prior estimates;
2. approximation schemes;
3. convergence.

In the first step, one assumes that the model under consideration has a "nice" solution. One proceeds to derive quantitative properties this solution enjoys. Here one looks for physical quantities that are conservative. The second step is devoted to the construction of approximate solutions. These solutions must be sufficiently smooth, yet they still satisfy the same a priori estimates obtained in the first step. Various versions of regularization, discretization, or penalty are often employed. In the last step one shows that the sequence of approximate solutions has a limit and this limit is a solution to the original model. Here one often faces the question of how to improve weak convergence to strong convergence. Some types of compactness arguments must be developed. In some cases, one must clarify the sense in which the limit satisfies the partial differential equations and the boundary contitions involved due to possible existence of singularities and/or degeneracy.