

Angxiu Ni

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Research interests

Numerical analysis, dynamical system, ergodic theory, numerical differentiation of chaos.

Education

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| 2017 - 2021 | Ph.D. | Applied math, University of California, Berkeley, USA.
Adviser: John Strain. |
| 2014 - 2017 | M.S.E. | Aerospace engineering, MIT, Cambridge, USA.
Adviser: Qiqi Wang. |
| 2011 - 2014 | M.S.E. | Engineering mechanics, Tsinghua University, Beijing, China.
Adviser: Haixin Chen. |
| 2007 - 2011 | B.E. | Mechanical engineering, Tsinghua University, Beijing, China. |

Awards and activities

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| May 2021 | Student Travel Award, SIAM DS21. |
| Mar 2021 | Student Travel Award, SIAM CSE21. |
| Mar 2021 | Organizer of the 2021 SIAM CSE minisymposium
“Linear response / sensitivity analysis / backpropagation in chaos”. |
| 2019 - 2020 | Richman fellowship, department of mathematics, UC Berkeley.
2 recipients from the all graduate students in the department. |

Teaching

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| Spring 2021 | GSI, math 228B (numerical PDE), UC Berkeley. |
| Fall 2020 | GSI, math 221 (matrix computations), UC Berkeley. |
| Summer 2019 | GSI, math W53 (multi-variable calculus), UC Berkeley. |
| Spring 2019 | GSI, math 128a (numerical analysis), UC Berkeley. |
| Fall 2018 | GSI, math 228a (numerical ODE), UC Berkeley. |
| Spring 2018 | GSI, math 128a (numerical analysis), UC Berkeley. |
| Fall 2017 | GSI, math 54 (linear algebra and ODE), UC Berkeley. |
| Fall 2015 | TA, 16.920 (numerical PDE), MIT. |

Publications and preprints

(The corresponding author is marked by * when applicable.)

- [1] “Fast linear response algorithm for differentiating stationary measures of chaos”, Angxiu Ni*, <https://arxiv.org/abs/2009.00595>, major revision at Journal de Mathématiques Pures et Appliquées. First push to arxiv: 1 Sep 2020; latest push to arxiv: 31 Mar 2021.
- [2] “Approximating linear response formula by non-intrusive shadowing algorithms”, Angxiu Ni*, <https://arxiv.org/abs/2003.09801>, minor revision at SIAM Journal on Numerical Analysis. First push to arxiv: 22 Mar 2020; latest push to arxiv: 25 Dec 2020.
- [3] “Linear range in gradient descent”, Angxiu Ni, Chaitanya Talnikar, <https://arxiv.org/abs/1905.04561> First push to arxiv: 11 May 2019; latest push to arxiv: 23 May 2019.
- [4] “Adjoint shadowing directions in hyperbolic systems for sensitivity analysis”, Angxiu Ni*, <https://arxiv.org/abs/1807.05568> First push to arxiv: 15 Jul 2018; latest push to arxiv: 24 Jul 2018; expecting another major update soon.
- [5] “Adjoint sensitivity analysis on chaotic dynamical systems by non-intrusive least squares adjoint shadowing (NILSAS)”, Angxiu Ni*, Chaitanya Talnikar, Journal of Computational Physics, Volume 395, Page 690-709, 15 October 2019.
- [6] “Hyperbolicity, shadowing directions, and sensitivity analysis of a turbulent 3-D flow”, Angxiu Ni*, Journal of Fluid Mechanics, Volume 863, Page 644-669, 28 January 2019.
- [7] “Sensitivity analysis on chaotic dynamical systems by finite difference non-intrusive least squares shadowing (FD-NILSS)”, Angxiu Ni*, Qiqi Wang, Pablo Fernandez, Chaitanya Talnikar, Journal of Computational Physics, Volume 394, Pages 615-631, 1 October 2019.
- [8] “Sensitivity analysis on chaotic dynamical systems by non-intrusive least squares shadowing (NILSS)”, Angxiu Ni*, Qiqi Wang, Journal of Computational Physics, Volume 347, Page 56-77, 15 October 2017.
- [9] “Least squares shadowing method for sensitivity analysis of differential equations”, Mario Chater, Angxiu Ni, Patrick Blonigan, Qiqi Wang, SIAM J. Numer. Anal., 55(6), 3030–3046, 30 November 2017.
- [10] “Simplified least squares shadowing sensitivity analysis for chaotic ODEs and PDEs”, Mario Chater*, Angxiu Ni, Qiqi Wang, Journal of Computational Physics 329, 126-140, 15 January 2017.
- [11] “An improvement to NSGA-II algorithm and its application in optimization design of multi-element airfoil”, Angxiu Ni, Yufei Zhang, Haixin Chen, Acta Aerodynamica Sinica 32 (2), 252-257, 2014.

Talks

- [1] "Fast Linear Response Algorithm for Differentiating Stationary Measure of Chaos", Mathematical Physics and Dynamical Systems Seminar, UC Riverside, June 8th, 2021, hosted by Michel Lapidus.
- [2] "Adjoint shadowing lemma for computing gradients of chaos via back-propagation", SIAM conference on applications of dynamical systems (DS21), May 2021, online.
- [3] "Fast Linear Response Algorithm for Differentiating Stationary Measure of Chaos", Dynamical systems seminar, Peking University, Mar 18, 2021, online.
- [4] "Fast Linear Response Algorithm for Differentiating Stationary Measure of Chaos", SIAM conference on computational science and engineering (CSE21), Mar 2, 2021, online.
- [5] "Differentiation of conditional SRB measures for maps and flows", Dynamics student seminar, Feb 18, 2021, Penn state University.
- [6] "Fast Linear Response Algorithm for Differentiating Stationary Measure of Chaos", Student Probability/PDE Seminar, Feb 12, 2021, UC Berkeley, US, hosted by Fraydoun Rezakhanlou.
- [7] "Linear response algorithm for differentiating SRB measures", Dynamical systems seminar, Dec 09, 2020, University of Loughborough, UK, hosted by Wael Bahoun.
- [8] "Linear response algorithm for SRB states", harmonic analysis and differential equations seminar, Oct 27, 2020, UC Berkeley.
- [9] "Expanding the unstable divergence", dynamics student seminar, Sep 24, 2020, Penn state University.
- [10] "Shadowing algorithms and linear response formula", dynamics student seminar, Sep 17, 2020, Penn state University.
- [11] "Towards sensitivity analysis on turbulence via shadowing methods", Angxiu Ni, center for turbulence research tea seminar, May 24, 2019, Stanford University, CA, USA, hosted by Parviz Moin.
- [12] "Adjoint shadowing directions in chaotic dynamical systems for sensitivity analysis", Angxiu Ni, SIAM conference on applications of dynamical systems (DS19), May 2019, Snowbird, Utah, U.S.
- [13] "Adjoint sensitivity analysis of chaotic dynamical systems via shadowing methods", Angxiu Ni, applied mathematics seminar, February 7th, 2019, UC Berkeley / Lawrence Berkeley Laboratory, Berkeley, CA, USA, hosted by Lin Lin.
- [14] "NILSAS: adjoint sensitivity analysis for chaos via computing adjoint shadowing directions", Angxiu Ni, Chaitanya Talnikar, SIAM conference on computational science and engineering (CSE19) Feb 2019, Spokane, Washington, USA.
- [15] "Characteristic Lyapunov vectors and the shadowing direction of a 3-D cylinder flow at Reynolds number 525", Angxiu Ni, Chaitanya Talnikar, Pablo Fernandez, Qiqi Wang, 70th annual meeting of the APS division of fluid dynamics, Nov 2017, Denver, Colorado, USA.

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- [16] “Computation of sensitivity and stability in chaotic flow by non-intrusive least squares shadowing (NILSS)”, Angxiu Ni, Qiqi Wang, 2017 SIAM annual meeting, Jul 2017, Pittsburgh, Pennsylvania, USA.
 - [17] “Sensitivity analysis on chaotic dynamical systems by non-intrusive least squares shadowing (NILSS), and challenges”, Angxiu Ni, Qiqi Wang, invited talk at the national institute of aerospace, June 14, 2017, hosted by Boris Diskin and Eric Nielsen.
 - [18] “Sensitivity analysis on chaotic dynamical systems by Non-Intrusive Least Squares Shadowing (NILSS)”, Angxiu Ni, Qiqi Wang, 2017 SIAM conference on computational science and engineering, Feb 2017, Atlanta, Georgia, USA.
 - [19] “Sensitivity analysis for chaotic dynamical systems using non-intrusive least square shadowing”, Angxiu Ni, Patrick J. Blonigan, Mario Chater, Qiqi Wang, and Zhichao Zhang, 2016 SIAM annual meeting, Jul 2016, Boston, Massachusetts, USA.
 - [20] “Sensitivity analysis for chaotic aeroelastic oscillations using non-intrusive least square shadowing”, Angxiu Ni, Patrick J. Blonigan, Mario Chater, Qiqi Wang, and Zhichao Zhang, 16th AIAA aviation, Jun 2016, Washington, D.C..
 - [21] “Dynamical behaviors of a thin plate under bypassing flow”, Angxiu Ni, Qiqi Wang, 68th annual meeting of the APS division of fluid dynamics, Nov 2015, Boston, USA.