Danny J. Smyl
curriculum vitae

Contact Information
Shelby Hall 3114 (251)460-6174
Mobile, Alabama dsmyl@southalabama.edu

Interests Applied mathematics, infrastructure materials, condition assessment, AI, inverse problems

Education

North Carolina State University, Raleigh, NC
Ph.D., Civil Engineering, 2017

University of Kansas, Lawrence, KS
M.S., Civil Engineering, May 2012
B.S., Civil Engineering, May 2011

Fulbright Scholar, Kuopio, Finland
Dept. of Applied Physics
University of Eastern Finland, August 2016 - May 2017

University of Sheffield, Sheffield, UK
Postgraduate Teaching Certificate, 2021

Professional Experience

Assistant Professor Jan 2022 - Present
Dept. of Civil, Coastal, and Environmental Engineering
University of South Alabama, Mobile, AL, USA

Lecturer in Structural Engineering Mar 2019 - Jan 2022
Dept. of Civil and Structural Engineering
University of Sheffield, Sheffield, UK

Postdoctoral Researcher July 2017 to Feb 2019
Dept. of Mechanical Engineering
Aalto University, Espoo, Finland

Captain, United States Marine Corps Sept 2011 to Sept 2016
Combat Engineer Officer

Honors and Awards

- SuperVisionary PhD Supervisor Award (Engineering Faculty, Sheffield) 2020
- EPSRC Engineering Early Career Forum 2019 - 2021
- McKenzie Fellow (U. Melbourne) – accepted lectureship in lieu of award 2018
- Paul Zia Fellowship Award (NCSU) – Structural Engineering 2016
- Fulbright Scholar 2016 - 2017

Funding

- EPSRC New Investigator Award: Three-dimensional electrical tomography for imaging large concrete members (£413,825; **PI**)
- EPSRC Strategic Eqipment Grant: Blast & Impact Diagnostics Laboratory (£1,414,737 total; **CO-I** share: £141,473)
- McKenzie Fellowship $295,000 (AUD), accepted lectureship in lieu of award
- EPSRC CASE PhD Studentship (£96,036 provided to student via EPSRC)
- £27,320 industrial funding raised from DSTL to support the CASE studentship
- UKCRIC Equipment Award £24,000
- Fulbright Award $28,500 (USD)

Total (funded and accepted): **$906,803** (USD)

Journal Publications

1. Gallet, A., Chen, L., Liew, A., Rigby, S., Hajirasouliha, I., Kong, X., Tallman, T., Liu, D., Hauptmann, A. and **Smyl, D.**. "Structural engineering from an inverse problems perspective." *Proceedings of the Royal Society A*, (2022).

2. Chen, L., Gallet, A., Huang, SS., Liu, D., and **Smyl, D.**, "Probabilistic Cracking Prediction via Deep Learned Electrical Tomography." *Structural Health Monitoring*, (2022).

3. Liu, D., Gu, D., **Smyl, D.**, Jiansong, D., and Du, J. "Supershape augmented reconstruction method based on Boolean operations in electrical impedance tomography." *IEEE Transactions on Instrumentation and Measurement*, (2021).

4. **Smyl, D.**, Tallman, T., Black, J., Hauptmann, A., and Liu, D. "Learning and Correcting Non-Gaussian Model Errors." *Journal of Computational Physics*, (2021).

5. **Smyl, D.**, Tallman, T., Liu, D., Hauptmann, A. "An efficient Quasi-Newton method for nonlinear inverse problems via learned singular values." *IEEE Signal Processing Letters*, (2021)

6. Hauptmann, A. and **Smyl, D.** "Fusing Electrical and Elastic Imaging." *Philosophical Transactions A*, (2021).

7. **Smyl, D.**, Lai, L., Chen, L., and Liu. D. "Non-cooperative finite element games." *Applied Numerical Mathematics*, (2021).

8. Liu, D., Gu, D., **Smyl, D.**, Jiansong, D., and Du, J. "Supershape recovery from electrical impedance tomography data." *Transactions on Computational Imaging*, (2021).

9. **Smyl, D.** "Electrical tomography for characterizing transport properties in cement-based materials: a review." *Construction and Building Materials*, (2020).

10. Tallman, T. and **Smyl, D.** "Structural health and condition monitoring via electrical impedance tomography in self-sensing materials: a review." *Smart Materials and Structures*, (2020).

11. Denis, A., Pannell, J., **Smyl, D.**, and Rigby, S. "Prediction of Blast Loading in an Internal Environment Using Artificial Neural Networks." *International Journal of Protective Structures*, (2020).

12. **Smyl, D.** and Liu, D. "Optimizing electrode positions in 2D Electrical Impedance Tomography using deep learning." *IEEE Transactions on Instrumentation and Measurement*, (2020).

13. **Smyl, D.** and Liu, D. "Self-filtering electrical area sensors emerging from deep learning." *Measurement Science and Technology*, (2020).

14. Liu, D., **Smyl, D.**, Gu, D. and Du, J. "Shape-driven difference electrical impedance tomography." *IEEE Transactions on Medical Imaging*, (2020).

15. Liu, D., Gu, D., **Smyl, D.**, Khambampati, A., Jiansong, D., and Du, J. "Shape-driven reconstruction using Fourier representations." *IEEE Transactions in Medical Imaging*, (2020).

16. Liu, D., Gu, D. **Smyl, D.**, Deng, J. and Du, J. "B-Spline Level Set Method for Shape Reconstruction in Electrical Impedance Tomography." *IEEE Transactions on Medical Imaging*, (2020).

17. Liu, D., Gu, D. **Smyl, D.**, Deng, J. and Du, J. "Multiphase conductivity imaging with Electrical Impedance Tomography and B-spline level set method." *IEEE Transactions on Instrumentation and Measurement*, (2020).

18. Liu, D., Gu, D. **Smyl, D.**, Deng, J. and Du, J. "Shape reconstruction using Boolean operations in electrical impedance tomography." *IEEE Transactions on Medical Imaging*, (2020).

19. **Smyl, D.** and Liu, D. "Less is often more: applied inverse problems using hp-forward models." *Journal of Computational Physics*, (2019).

20. **Smyl, D.**, Bossuyt, S., Ahmad, W., Vavilov, A., and Liu, D. "An overview of 38 least squares-based frameworks for structural damage tomography." *Structural Health Monitoring*, (2019).

21. **Smyl, D.** and Liu, D. "Invisibility and indistinguishability in structural damage tomography." *Measurement Science and Technology*, (2019).

22. **Smyl, D.** and Liu, D. "Damage tomography as a state estimation problem: crack detection using conductive area sensors." *IEEE Sensors Letters*, (2019).

23. Antin, Kim-Nikolas, Laukkanen, A., Andersson, T., **Smyl, D.**, and Vilaca, P. "A multiscale modelling approach for estimating the effect of defects in unidirectional carbon fiber reinforced polymer composites." *Materials*, (2019).

24. Liu, D., **Smyl, D.**, and Du, J. "Nonstationary shape estimation in electrical impedance tomography using a parametric level-set-based extended Kalman filter approach." *IEEE Transactions on Instrumentation & Measurement*, (2019).

25. **Smyl, D.**, Bossuyt, S., and Liu, D. "OpenQSEI: a MATLAB package for Quasi Static Elasticity Imaging." *SoftwareX*, (2019).

26. Liu, D., Gu, D., **Smyl, D.**, Deng, J., and Du, J. "B-spline based sharp feature preserving shape reconstruction approach for electrical impedance tomography." *IEEE Transactions on Medical Imaging*, (2019).

27. Liu, D., **Smyl, D.**, and Du, J. "A Parametric Level Set based Approach to Difference Imaging in Electrical Impedance Tomography." *IEEE Transactions on Medical Imaging*, (2019).

28. **Smyl, D.**, Antin, Kim-Nikolas, Liu, D, and Bossuyt, S. "Coupled Digital Image Correlation and Quasi-Static Elasticity Imaging of inhomogeneous orthotropic composite structures." *Inverse Problems*, (2018).

29. **Smyl, D.**, Seppänen, A., and Pour-Ghaz, M. "Detection and reconstruction of complex structural cracking patterns with electrical imaging" *NDT & E International*, (2018)

30. **Smyl, D.**, Bossuyt, S., and Liu, D. "Stacked elasticity imaging approach for visualizing defects in the presence of background inhomogeneity." *ASCE Journal of Engineering Mechanics*, (2018).

31. **Smyl, D.** "An inverse method for optimizing elastic properties considering multiple loading conditions and displacement criteria." *ASME Journal of Mechanical Design*, (2018)

32. **Smyl, D.** "Relating Unsaturated Electrical and Hydraulic Conductivity of Cement-Based Materials." *Australian Journal of Civil Engineering*, (2018).

33. **Smyl, D.** "Recommendations and interpretations for the tortuosity and pore-connectivity parameter in undamaged cement-based materials." *Journal of Sustainable Cement-Based Materials*, (2018).

34. Bailey, L., **Smyl, D.**, Bossuyt, S., and Bossuyt, J. "Quantifying Nuclear Remodeling in Heart Failure." *Biophysical Journal*, (2018).

35. **Smyl, D.**, Rashetnia, R., Seppänen, A., and Pour-Ghaz, M. "Can Electrical Resistance Tomography Be Used for Imaging Unsaturated Moisture Flow in Cement-Based Materials With Discrete Cracks?" *Cement and Concrete Research*, (2017).

36. Rashetnia, R., Hallaji, M., **Smyl, D.**, Seppänen, A., and Pour-Ghaz, M. "Detection and localization of changes in two-dimensional temperature distributions by electrical resistance tomography" *Smart Materials and Structures*, (2017).

37. **Smyl, D.**, Ghasemzadeh, F., and Pour-Ghaz, M. "Can the Dual-Permeability Model be Used to Simulate Unsaturated Moisture Flow in Damaged Mortar and Concrete?" *International Journal of Advances in Engineering Sciences and Applied Mathematics* (2017).

38. **Smyl, D.**, Hallaji, M., Seppänen, A., and Pour-Ghaz, M. "Quantitative Electrical Imaging of Three-Dimensional Moisture Flow in Cement-Based Materials." *International Journal of Heat and Mass Transfer*, (2016).

39. **Smyl, D.**, Ghasemzadeh, F., and Pour-Ghaz, M. "Modeling Water Absorption in Concrete and Mortar with Distributed Damage." *Construction and Building Materials*, (2016).

40. **Smyl, D.**, Hallaji, M., Seppänen, A., and Pour-Ghaz, M. "Three-dimensional electrical impedance tomography to monitor unsaturated moisture ingress in cement-based materials." *Transport in Porous Media*, (2016).

41. Ghasemzadeh, F., Rashernia, R., **Smyl, D.**, and Pour-Ghaz, M. "A Comparison of Methods to Evaluate Mass Transport in Damaged Mortar." *Cement and Concrete Composites*, (2016).

Conference Publications

1. Liu, D., **Smyl, D.**, Du, J., "Comparison of different radial basis functions for parametric level set based method in electrical impedance tomographyr." *9th World Congress in Industrial Process Tomography, Bath, UK*, (2018).

2. Rashetnia, R., **Smyl, D.**, Hallaji, M., Seppänen, A., and Pour-Ghaz, M. "A Novel Two-dimensional Distributed Temperature Sensor Based on Electrical Resistance Tomography." *Structural Health Monitoring, Stanford, California*, (2017).

3. Rashetnia, R., **Smyl, D.**, Hallaji, M., Seppänen, A., and Pour-Ghaz, M. "Structural Health Monitoring using Electrical Resistance Tomography Based Sensing Skin: Detecting damage, corrosive elements, and temperature change." *ICIPE, Waterloo, Ontario, Canada*, (2017).

4. **Smyl, D.**, Hallaji, M., Seppänen, A., and Pour-Ghaz, M. "Three-Dimensional Electrical Imaging of Moisture Ingress in Mortar." *ACI Special Publication* 312: 1-22, (2016).

5. Seppänen, A., Hallaji, M., **Smyl, D.**, and Pour-Ghaz, M. "Electrical Impedance Tomography to Monitor Unsaturated Moisture Flows, and to Detect Corrosive Elements and Cracking in Cementitious Materials." *8th European Workshop On Structural Health Monitoring, Bilbao, Spain*, (2016).

Technical Reports

1. **Smyl, D.**, Park, S., Mohammadian, A., Lucier, G. Pour-Ghaz, M. "The Use of Fiber Reinforcement in Latex-Modified Concrete Overlays." *North Carolina Dept. of Transportation Report: NCDOT RP 2016-17*, (2016).
2. **Smyl, D.**. "Methods of Predicting Aggregate Voids." *Kansas Dept. of Transportation Report: FHWA-KS-12-8*, (2013).

Selected Presentations

1. **Smyl, D.** "Recent advances in inverse problems applied to SHM and NDE." *Purdue and Marquette Universities (Colloquium)*, (2021).
2. **Smyl, D.** "Rapid Imaging of Structural Damage." *Applied Inverse Problems Conference, 2019, Grenoble, France*, (2019).
3. **Smyl, D.** "Inverse Problems in Structural Engineering and Construction Materials." *IDCOMS Seminar, Edinburgh, UK*, (2019).
4. **Smyl, D.**, Bossuyt, S. "Joint DIC-Elasticity Imaging of Damage in the Presence of Material Inhomogeneity." *Society of Experimental Mechanics Annual Conference, Greenville, South Carolina*, (2018).
5. **Smyl, D.**, Seppänen, A., Hallaji, M., and Pour-Ghaz, M. "Layered Sensing Skin to Detect Cracking and Chlorides in Concrete Elements." 7^{th} *Advances in Cement-Based Materials, American Ceramic Society, Northwestern University, Evanston, Illinois*, (2016).
6. **Smyl, D.**, Seppänen, A., Hallaji, M., and Pour-Ghaz, M. "Visualizing Unsaturated Moisture Flow in Cement-Based Materials Using Electrical Methods." 7^{th} *Advances in Cement-Based Materials, American Ceramic Society, Northwestern University, Evanston, Illinois*, (2016).
7. **Smyl, D.**, Ghasemzadeh, F., and Pour-Ghaz, M. "Unsaturated Moisture Transport in Damaged Concrete and Mortar: Numerical and Experimental Investigation." *Open Topics ACI National Convention, Milwaukee, WI*, (2016).
8. Seppänen, A., Hallaji, M., **Smyl, D.**, and Pour-Ghaz, M. "Electrical Impedance Tomography to Monitor Unsaturated Moisture Flows, and to Detect Corrosive Elements and Cracking in Cementitious Materials." 8^{th} *European Workshop On Structural Health Monitoring, Bilbao, Spain*, (2016).
9. **Smyl, D.**, Hallaji, M., Seppänen, A., and Pour-Ghaz, M. "Three-Dimensional Electrical Impedance Tomography to Monitor Unsaturated Moisture Flow in Cement-Based Materials." *Research in Progress, ACI National Convention, Denver, CO*, (2015).
10. Pour-Ghaz, M., **Smyl, D.**, Hallaji, M., and Seppänen, A. "Damage Detection and Moisture Flow Monitoring in Concrete Structures using Electrical Impedance Tomography." *2015 Inverse Days, Lappeenranta University of Technology, Lappeenranta, Finland*, (2015).

Advising

Primary Adviser/Chair:

1. Niki Trochoutsou (Postdoc), *EPSRC New Investigator Award: Three-dimensional electrical tomography for imaging large concrete members*, June 2021 - present, University of Sheffield.
2. Liang Chen (PhD), *Deep Learned Electrical Tomography for Imaging Damage*, expected graduation: December 2022, University of Sheffield.

3. Adrien Gallet (PhD), *Physically Informed Neural Networks for Conceptual Structural Design*, **Faculty of Engineering (UPGRC) PhD Studentship Award**, expected graduation: September 2023, University of Sheffield.

4. Zhiqin Shu (MSc), *Can Cracks Decrease The Permeability Of Concrete?*, graduated September 2021, University of Sheffield.

5. Jennifer Digby (MEng), *Implementation of Artificial Neural Networks for the Structural Health Monitoring of Built Bridges*, graduated September 2021, University of Sheffield.

6. Jianwen Wu (MSc), *How Cracks Affect the Permeability of Concrete*, graduated September 2021, University of Sheffield.

7. Kaiping Zhang (MSc), *Structural Damage Identification Method by Relative Flexibility Difference Curvature Matrix*, graduated September 2020, University of Sheffield.

8. Peilin Lai (MSc), *Simulation of Crack Permeability in Saturated Concrete*, graduated September 2020, University of Sheffield.

9. Adrien Gallet (MEng), *2D/3D Dimensional Imaging of Complex Damage of Concrete Elements Using Electrical Resistance Tomography*, graduated September 2020, University of Sheffield.

Teaching Experience

Lecturer — Fall 2021
Structural Health Monitoring and Asset Management
University of Sheffield, 20 Students

Lecturer — Spring 2021
Civil and Structural Engineering Mechanics 1
University of Sheffield, 172 Students

Lecturer (newly-developed module) — Fall 2020
Structural Health Monitoring and Asset Management
University of Sheffield, 16 students

Lecturer — Spring 2020
Civil and Structural Engineering Mechanics 1
University of Sheffield, 161 students

Co-Lecturer — Fall 2019
Further Civil Engineering Mathematics and Computing
University of Sheffield

Assistant Lecturer — Winter 2018
Non-Destructive Testing
Aalto University

Teaching Assistant — Spring 2016
Properties of Concrete and Advanced Cement-Based Composites
North Carolina State University

Teaching Assistant — Summer 2015
CE 426 - Steel Design
North Carolina State University

Officer in Charge — Summer 2015
Sapper Leaders' Course
4th Combat Engineer Battalion
Camp Lejune, NC

Grading Assistant — Fall 2011
CE 563 - Concrete Design
University of Kansas

FACULTY SERVICE

- [Sheffield] Program Lead, *MSc Infrastructure & Urban Systems Engineering* (2019 - 2021)
- [Sheffield] Program Lead, *MSc Structural Engineering* (2020 - 2021)
- [Sheffield] Co-Champion, *Undergrad Python programming initiative*
- [Sheffield] Engineering Open Days Lead (2019)
- [Sheffield] Research Committee EPSRC Representative
- [Sheffield] Faculty Selection Committee (5)
- [Sheffield] Internal PhD Viva examiner (5)
- [Sheffield] ICAIR Executive Committee (2019 - 2021)

PROFESSIONAL SERVICE

Member, EPSRC Engineering Early Career Forum (2019-2021)
Member, *Society of Experimental Mechanics*
Member, *American Concrete Institute*
Member, *Suomen Inversioseura (Finnish Inverse Problems Society)*
Associate Member, *American Society of Civil Engineers (ASCE)*
Member, *American Society of Military Engineers*
Grant review

- Austrian Federal Ministry of Education, Science and Research
- Cara Syria Programme

Article review

- **Engineering Journals**: Structural Health Monitoring, Engineering Structures, Smart Materials and Structures, Journal of Nondestructive Evaluation, Automation in Construction, Computer Methods in Applied Mechanics and Engineering, Composites Part B: Engineering, Cement and Concrete Composites, ACI Materials Journal, ACI Structural Journal, Materials and Structures, Materials and Design, Journal of Infrastructure Systems, Journal of Materials in Civil Engineering, Construction and Building Materials, Journal of Building Engineering, Journal of Infrastructure Systems, Optimization and Engineering, Nuclear Engineering and Design Advances in Structural Engineering, Materials, Building Pathology and Rehabilitation, ES Materials and Manufacturing
- **Science/Mathematical Journals**: Measurement Science and Technology, IEEE Transactions on Medical Imaging, IEEE Transaction on Computation Imaging, IEEE Transactions on Instrumentation & Measurement, IEEE Sensors Journal, IEEE Sensors Letters, IEEE Transactions on Industrial Electronics, Journal of Imaging, Sensors, SN Applied Sciences, Micromachines, Measurement, Biosensors and Bioelectronics, SoftwareX, HardwareX