

# JULIÁN NORATO

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## PRESENT POSITION

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### **Associate Professor, Department of Mechanical Engineering**

University of Connecticut, Aug. 2020–Present

**Institutional affiliations:** Institute of Materials Science (IMS), UTC Institute for Advanced Systems Engineering (IASE), Krenicki Arts & Engineering Institute, and National Institute for Undersea Vehicle Technology (NIUVT)

## ACADEMIC BACKGROUND

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### EDUCATION

PhD in Mechanical Engineering with Specialization in Computational Science and Engineering, University of Illinois at Urbana-Champaign, 2005

MS in Mechanical Engineering with Specialization in Computational Science and Engineering, University of Illinois at Urbana-Champaign, 2003

BS in Mechanical Engineering, Universidad Nacional de Colombia, Colombia, 1997

### RESEARCH INTERESTS

My current research interests lie in **simultaneously incorporating manufacturing, cost, and material failure considerations in topology optimization** for the design exploration of efficient structures tailored to a manufacturing process, and with applications across domains, including aircraft structures, architected lattices, heat exchangers and patient-specific bone scaffolds.

### HONORS AND AWARDS

Invited participant to German-American Frontiers of Engineering Symposium co-organized by National Academy of Engineers and Humboldt Foundation, 2021

Air Force Research Lab Summer Faculty Fellow, 2020 and 2021

**ASME Design Automation Young Investigator Award**, 2019

**NSF CAREER Award**, CMMI Division / EDSE Program, 2018

**Office of Naval Research Young Investigator Award**, 2017

ME Early Career Faculty Scholar Award, 2017

Caterpillar's Move the Mountain Award, 2014

Danish Center for Applied Mathematics and Mechanics Grant for doctoral summer course, 2002

General Scholarship for Graduate Studies Overseas, The Foundation for the Future of Colombia (COLFUTURO), 1999

## PROFESSIONAL EXPERIENCE

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- Assistant Professor, University of Connecticut, *Aug. 2014–Jul. 2020*
- Engineering Supervisor, Product Optimization, Caterpillar Inc., *Jan. 2014–Jul. 2014*
- Visiting Lecturer, Dept. of Mechanical Science and Engineering, University of Illinois at Urbana-Champaign, *Jan. 2014–May 2014*.
- Engineering Supervisor, Structural Optimization, Caterpillar Inc., *Jan. 2012–Dec. 2013*
- Engineering Specialist Research/Development, Caterpillar Inc., *Apr. 2010–Dec. 2011*
- Sr. Research Engineer, Caterpillar Inc., *Apr. 2006–Mar. 2010*
- Sr. Project Engineer, Belcan Corporation, *Dec. 2004–Mar. 2006*
- Graduate Research Assistant, Center for Process Simulation and Design, University of Illinois at Urbana-Champaign, *Aug. 2001–Dec. 2004*

## PROFESSIONAL AFFILIATIONS AND SERVICE

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**Summary:** Review Editor for Structural and Multidisciplinary Optimization and Associate Editor for the Journal of Mechanical Design. Member of local organizing committee for the 14th World Congress of Structural and Multidisciplinary Optimization (2021) and Conference Chair of the ASME Design Automation Conference (2021). Invited Guest Editor for two special issues of SMO and one of JMD. Several committee memberships and numerous conference organization activities.

## EDITORIAL SERVICE

- **Review Editor, Journal of Structural and Multidisciplinary Optimization**, Dec. 2013–Present
- **Associate Editor, ASME Journal of Mechanical Design**, Aug. 2020–Present
- Invited Guest Editor for Special Issue on 14th World Congress of Structural and Multidisciplinary Optimization (Present)
- Invited Guest Editor for upcoming Special Issue on Design Methods for Advanced Manufacturing in ASME Journal of Mechanical Design (Present)
- Invited Guest Editor for Special Issue Dedicated to Founding Editor George Rozvany of the Journal of Structural and Multidisciplinary Optimization, Dec. 2015
- Reviewer for the following publications: Computer Methods in Applied Mechanics and Engineering, International Journal of Numerical Methods in Engineering, Structural and Multidisciplinary Optimization, ASME Journal of Mechanical Design, Computer-Aided Design, Finite Elements in Analysis and Design, Mechanism and Machine Theory, Journal of Optimization Theory and Applications, Journal of Manufacturing Science and Engineering and PLOS ONE

## AMERICAN SOCIETY OF MECHANICAL ENGINEERS

- **Member of Executive Committee of Design Automation Committee**, Aug. 2019–Present
- **Program Chair, ASME Design Automation Conference**, 2021
- Member of the ASME Design Automation Committee, 2012–Present
- **Invited Co-organizer of Journal of Mechanical Design Webinar**, Sept. 16, 2021
- Industry Liaison of the ASME Design Automation Committee, Mar. 2012–Aug. 2014
- Organizer of panel on “Industrial Design Automation in the Cloud: Opportunities and Challenges” at the *38th Design Automation Conference*, Chicago, Illinois, Aug. 2012
- Co-organizer, Paper Review Coordinator and/or Co-Chair of Technical Sessions on “Design of Engineering Materials and Structures” and “Novel Applications of Structural Optimization” at every *ASME Design Automation Conference* from 2012 to 2020. Creator and co-organizer of Technical Session on “Computational Design for Biomedical Applications”, 2019, 2020 and 2021.

## INTERNATIONAL SOCIETY OF STRUCTURAL AND MULTIDISCIPLINARY OPTIMIZATION

- **Member of Local Organizing Committee for 14th World Congress of Structural and Multidisciplinary Optimization**, Jul. 2021

- **Invited Host of TOP Webinar** (organized by Delft University and Technical University of Denmark), Nov. 2020
- **Member of International Papers Committee for WCSMO (Beijing)**, 2019.
- Member of Scientific Advisory Committee and Co-chair of Technical Session at the World Congresses in Structural and Multidisciplinary Optimization, 2013 (Orlando), 2015 (Sydney), 2017 (Braunschweig) and 2019 (Beijing).

#### UNITED STATES ASSOCIATION OF COMPUTATIONAL MECHANICS

- Co-organizer of technical sessions in the US National Congress of Computational Mechanics, 2009 (Columbus), 2014 (Montreal), 2019 (Austin) and 2021 (Chicago/virtual).
- Co-organizer of a technical session in the World Congress of Computational Mechanics, 2018 (New York City), 2021 (Paris/virtual), 2022 (Yokohama).

#### AMERICAN INSTITUTE OF AERONAUTICS AND ASTRONAUTICS

- Member of the Multidisciplinary Optimization Technical Committee, *Apr. 2008–Jan. 2011*
- Session Chair and Paper Reviewer of Technical Sessions on “MA&O - Product Design” and “Topology Optimization” at the *13th AIAA/ISSMO Multidisciplinary Analysis Optimization (MAO) Conference*, Fort Worth, Texas, Sep. 2010.

#### PUBLICATIONS

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**Summary: 1828 Google Scholar citations as of 09/19/21; h-index = 19 and i-10 index = 23.**  
28 journal articles and 12 papers in conference proceedings. Two articles in special issues.

#### ARTICLES IN REVIEW

1. Kazemi, H., and Norato, J.A. (2021) “Topology optimization of programmable lattices with geometric primitives.” *Structural and Multidisciplinary Optimization*.
2. Smith, H., and Norato, J.A. (2021) “Topology Optimization of Structures Made of Fiber-Reinforced Plates.” *Structural and Multidisciplinary Optimization*.

#### JOURNAL ARTICLES

1. Cohen, D., Aboutaleb, S.M.G., Wagoner Johnson A.J., and Norato, J.A. (2020) “Bone adaptation-driven design of periodic scaffolds.” *Journal of Mechanical Design*, 143 (12), 121701. DOI: <https://doi.org/10.1115/1.4050928>.
2. Kazemi, H., and Norato, J.A. (2021) “Topology optimization of lattices with anisotropic struts.” *Structural and Multidisciplinary Optimization*, 63:1653–1668. DOI: <https://doi.org/10.1007/s00158-020-02822-x>.
3. Smith, H., and Norato, J.A. (2021) “Topology optimization with discrete geometric components made of composite materials.” *Computer Methods in Applied Mechanics and Engineering*, 376, 113582, DOI: <https://doi.org/10.1016/j.cma.2020.113582>.
4. Wein, F., Dunning, P.D., and Norato, J.A. (2020) “A review on feature-mapping methods for structural optimization.” *Structural and Multidisciplinary Optimization*, 62:1597–1638. DOI: <https://doi.org/10.1007/s00158-020-02649-6>.
5. Sanders, C., Norato, J., Walsh, T., and Aquino, W. (2020) “An error-in-constitutive equations strategy for topology optimization for frequency-domain dynamics.” *Computer Methods in Applied Mechanics and Engineering*, 372, 113330, DOI: <https://doi.org/10.1016/j.cma.2020.113330>.
6. Smith, H., and Norato, J.A. (2020) “A MATLAB code for topology optimization using the geometry projection method.” *Structural and Multidisciplinary Optimization*, 62:1579–1594. DOI: <https://doi.org/10.1007/s00158-020-02552-0>.

7. Zhang, S., Gain, A.L., and Norato, J.A. (2020) “Adaptive mesh refinement for topology optimization with discrete geometric components.” *Computer Methods in Applied Mechanics and Engineering*, 364, 112930, DOI: <https://doi.org/10.1016/j.cma.2020.112930>.
8. Kazemi, H., Vaziri, A., and Norato, J.A. (2020) “Multi-material topology optimization of lattice structures using geometry projection.” *Computer Methods in Applied Mechanics and Engineering*, 363, 112895. DOI: <https://doi.org/10.1016/j.cma.2020.112895>.
9. Armstrong, A.A., Norato, J., Alleyne, A.G., and Wagoner Johnson, A.J. (2019) “Direct process feedback in extrusion-based 3D bioprinting.” *Biofabrication*, 12(1): 015017. DOI: <https://doi.org/10.1088/1758-5090/ab4d97>.
10. Zhang, S., Le, C., Gain, A.L., and Norato, J.A. (2018) “Fatigue-based topology optimization with non-proportional loads.” *Computer Methods in Applied Mechanics and Engineering*, 345, 805-825.
11. Xiong, J., Du, Y., Mousanezhad, D., Asl, M.E., Norato, J., and Vaziri, A. (2018) “Sandwich structures with prismatic and foam cores: a review.” *Advanced Engineering Materials*, 21(1), 1800036.
12. Kazemi, H., Vaziri, A., and Norato, J.A. (2018) “Topology optimization of structures made of discrete geometric components with different materials.” *ASME Journal of Mechanical Design, Special Issue on Design of Engineered Materials and Structures*, 140, p. 111401-11. **Recognized by EIC as fourth most cited JMD paper out of all papers published in 2018–2019.**
13. Norato, J.A. (2018) “Topology optimization with supershapes.” *Structural and Multidisciplinary Optimization*, 58(2), p. 415-434, 2018.
14. Ebrahimi, H., Someh, L. K., Norato, J., and Vaziri, A. (2018). “Blast-resilience of honeycomb sandwich panels.” *International Journal of Mechanical Sciences* 144, p. 1–9.
15. Ebrahimi, H., Mousanezhad, D., Nayeb-Hashemi, H., Norato, J., and Vaziri, A. (2017) “3D cellular metamaterials with planar anti-chiral topology.” *Materials and Design* 145, 226-231.
16. Zhang, S., Gain, A.L., and Norato, J.A. (2017) “A geometry projection method for the topology optimization of curved plate structures with placement bounds.” *International Journal of Numerical Methods for Engineering*, 2017;1–19. <https://doi.org/10.1002/nme.5737>.
17. Picelli, R., Townsend, S., Brampton, C., Norato, J., and Kim, H. A. (2018) Stress-based shape and topology optimization with the level set method. *Computer Methods in Applied Mechanics and Engineering*, 329, 1–23.
18. Roberge, J., and Norato, J. Computational design of curvilinear bone scaffolds fabricated via direct ink writing. (2018) *Computer-Aided Design*, 95, 1–13.
19. Zhang, S., Gain, A. L., and Norato, J.A. (2017) “Stress-based topology optimization with discrete geometric components.” *Computer Methods in Applied Mechanics and Engineering*, 325, p. 1–21, DOI: 10.1016/j.cma.2017.06.025.
20. Zhang, S., and Norato, J. A. (2017) “Optimal design of panel reinforcements with ribs made of plates.” *ASME Journal of Mechanical Design*, 139, p. 081403-1–081403-11. DOI: 10.1115/1.4036999, 2017. **(Featured in the Journal’s Companion Website).**
21. Zhang, S., Norato, J. A., Gain, A. L., and Lyu, N. (2016) “A geometry projection method for the topology optimization of plate structures.” *Structural and Multidisciplinary Optimization*, invited contribution for Special issue dedicated to Founding Editor George Rozvany., 54(5), p. 1173–1190, DOI: 10.1007/s00158-016-1466-6.
22. Norato, J., Bell B., and Tortorelli, D. (2015) “A geometry projection method for continuum-based topology optimization with discrete elements”, *Computer Methods in Applied Mechanics and Engineering*, 293, p. 306–327.
23. Shin, M., Tortorelli, D.A., and Norato, J.A. (2015) “Optimal shape design of axisymmetric structures subject to asymmetric loading”, *Computer Methods in Applied Mechanics and Engineering*, 293, p. 283–305.
24. Norato, J., and Wagoner Johnson, A. (2011) “A computational and cellular solids approach to the stiffness-based design of bone scaffolds”, *ASME Journal of Biomechanical Engineering*, 133(9).
25. Le, C., Norato, J., Bruns, T., Ha, C., and Tortorelli, D. (2010) “Stress-based topology optimization for continua”. *Structural and Multidisciplinary Optimization*, 41(4), p. 605–620.

26. Silva, M., Tortorelli, D.A., Norato, J.A., Ha, C., and Bae, H-R. (2010) “Component and system reliability-based topology optimization using a single-loop method”. *Structural and Multidisciplinary Optimization*, 41(1), p. 87–106.
27. Norato, J.A., Bendsøe, M.P., Haber, R.B., and Tortorelli, D.A. (2007) “A topological derivative method for topology optimization”. *Structural and Multidisciplinary Optimization*, 33(4-5), p. 375–386.
28. Norato, J.A., Haber, R.B., Tortorelli, D.A., and Bendsøe, M.P. (2004) “A geometry projection method for shape optimization”. *International Journal for Numerical Methods in Engineering*, 60(14), p. 2289–2312.

## CONFERENCE PROCEEDINGS

1. Smith, H., Norato, J.A. (2021) “Topology Optimization of Fail-Safe Structures via Geometry Projection”. In *AIAA Scitech 2021 Forum*, AIAA 2021-2026. DOI: 10.2514/6.2021-2026.
2. Smith, H., Norato, J. A. (2020). “A Topology Optimization Method for the Design of Orthotropic Plate Structures”. In *ASME 2020 International Design Engineering Technical Conferences and Computers and Information in Engineering Conference* , DETC2020-22400, V11AT11A054. DOI: 10.1115/DETC2020-22400.
3. Kazemi, H., Vaziri, A., Norato, J. A. (2019). “Topology optimization of multi-material lattices for maximal bulk modulus”. In *ASME 2019 International Design Engineering Technical Conferences and Computers and Information in Engineering Conference* , DETC2019-97370, V02AT03A052. DOI: 10.1115/DETC2019-97370.
4. Smith, H., Norato, J.A. (2019) “Geometric constraints for the topology optimization of structures made of primitives”. In *SAMPE Conference Proceedings*, DOI: 10.33599/nasampe/s.19.1518.
5. Smith, H., Norato, J.A. (2019) “A geometry projection method for the design exploration of wing-box structures”. In *AIAA Scitech 2019 Forum*, AIAA 2019-2353. DOI: 10.2514/6.2019-2353.
6. Zhang, S., Norato, J. A. (2018). “Finding better local optima in topology optimization via tunneling”. In *ASME 2018 International Design Engineering Technical Conferences and Computers and Information in Engineering Conference*, DETC2018-86116, V02BT03A014. DOI: 10.1115/DETC2018-86116.
7. Picelli, R., Townsend, S., Brampton, C., Norato, J., Kim, H.A. (2017) “Stress minimization using the level set topology optimization,” In *Proceedings of the 58th AIAA/ASCE/AHS/ASC Structures, Structural Dynamics, and Materials Conference*, DOI: 10.2514/6.2017-1544.
8. Zhang, S., and Norato, J. A. (2016) “A geometry projection method for the optimal design of panel reinforcements with ribs made of plates.” In *Proceedings of the ASME 2016 International Design Engineering Technical Conferences and Computers and Information in Engineering Conference*, DETC2016-59985, V02BT03A011.
9. Norato, J.A. (2015) “A geometry projection method for the optimal distribution of short fiber reinforcements.” In *Proceedings of the ASME 2015 International Design Engineering Technical Conferences and Computers and Information in Engineering Conference*, V02BT03A010.
10. Bell, B., Norato, J., and Tortorelli, D. (2012) “A geometry projection method for continuum-based topology optimization of structures”, *Proceedings of the 14th AIAA/ISSMO Multidisciplinary Analysis and Optimization Conference*.
11. Lu, S., Kim, H.M., Norato, J., and Ha, C. (2008) “Analytical Target Cascading for Multi-Mode Design Optimization: An Engine Case Study”, *Proceedings of the 4th AIAA Multidisciplinary Design Optimization Specialist Conference*.
12. Norato, J.A., Haber, R.B., Tortorelli, D.A., and Bendsøe, M.P. (2005) “A Geometry Projection and Optimality Criterion Method for Topology Optimization using the Topological Derivative”, *Proceedings of the 6th World Congress on Structural and Multidisciplinary Optimization, Rio de Janeiro*.

## PATENTS

1. Vijay Yalamanchili, Justin Mach, Julian Norato, and Badrinarayan Athreya, “Method and system for determining welding process parameters”. Sept. 2017. U.S. Patent 10,325,036.

2. Julian Norato, Sungmoon Jung, Badrinarayan Athreya, and Christopher Ha, “Method and system for determining welding sequences”. Issued Aug. 2015. U.S. Patent 9,102,012.

## INVITED TALKS

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1. Aerospace Engineering Seminar (virtual), School of Aerospace Engineering, Georgia Institute of Technology, Oct. 2021
2. Applied Mathematics Seminar (virtual), Dept. of Mathematics, Universidad Nacional de Colombia, Bogotá, Dec. 2020
3. TOP Webinar, co-organized by Delft University and Technical University of Denmark, Jun. 2020
4. Workshop on “Connecting FEA, HPC and AM via Optimization”, Lawrence Livermore National Laboratory, Jan. 2020
5. Seminar Speaker, Institut Supérieur de l’Aéronautique et de l’Espace, SUPAERO, Toulouse, France, Dec. 2019
6. Minisymposium Keynote Speaker, World Congress in Computational Mechanics, New York City, NY, Jul. 2018
7. Minisymposium Keynote Lecturer, European Conference in Computational Mechanics (ECCOMAS), Glasgow, Scotland, Jun. 2018
8. Dept. of Mechanical Eng. and Mechanics Seminar, Drexel University, Philadelphia, PA, Apr. 2018
9. Dept. of Mechanical Eng. Seminar, The City College of New York, New York, NY, Mar. 2018
10. Dept. of Mechanical Eng. Seminar, Worcester Polytechnic Institute, Worcester, MA, Jan. 2018
11. Dept. of Civil Eng. Seminar, Duke University, Durham, NC, Sept. 2016
12. National Laboratory of Scientific Computing, Petrópolis, Brazil, Jun. 2016
13. Sandia National Laboratory Roundtable on Topology Optimization, Houston, TX, Mar. 2016
14. Dept. of Mechanical Eng. Seminar, State University of New York, Stony Brook, NY, Jan. 2016
15. Keynote Talk at the *Symposium on Structural Multidisciplinary Design and Simulation-Based Optimization: Recent Applications & Future*, Northwestern University, Evanston, IL, Dec. 2014
16. Panel Discussion on Industrial Applications of Structural and Multidisciplinary Optimization at the *10th World Congress in Structural and Multidisciplinary Optimization*, Orlando, FL, May 2013
17. Lindbergh Lecture, Dept. of Mechanical Eng. Seminar, University of Wisconsin, Madison, WI, Apr. 2013
18. Keynote Industry Talk at the *Symposium on Structural Multidisciplinary Design and Simulation-Based Optimization: Recent Applications & Future.*, Northwestern University, Evanston, IL, Dec. 2012
19. Industry Panel at the *National Science Foundation Workshop on the Future of Multidisciplinary Design Optimization: Advancing the Design of Complex Systems*, Fort Worth, TX, Sep. 2010
20. Dept. of Civil and Environmental Eng. Seminar, Cornell University, Ithaca, NY, Mar. 2007