Curriculum Vitae

Daniel R. Herber

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Academic Appointments

8/2019–Present *Assistant Professor*, Colorado State University, Department of Systems Engineering

1/2018–7/2019 *Postdoctoral Research Associate*, University of Illinois at Urbana-Champaign, NSF Center for Power Optimization of Electro-Thermal Systems (POETS)

Education

8/2014–12/2017 *Ph.D.* in *Systems and Entrepreneurial Engineering*, University of Illinois at Urbana–Champaign, adviser—James T. Allison
Dissertation: *Advances in combined architecture, plant, and control design*

8/2012–5/2014 *M.S.* in *Systems and Entrepreneurial Engineering*, University of Illinois at Urbana–Champaign, adviser—James T. Allison

8/2008–12/2011 *B.S.* in *General Engineering*, highest honors, University of Illinois at Urbana–Champaign, physics minor, applied statistics secondary field of concentration

Research Interests

Methodology design optimization · computational design · model-based systems engineering · system architecture synthesis · architecture graph representations and enumeration · artificial intelligence in engineering design · modeling and simulation of dynamic systems · multidisciplinary dynamic system design optimization · combined physical and control system design (control co-design) · dynamic optimization · numerical methods for optimal control · direct transcription · pseudospectral methods

Applications energy systems (ocean wave energy converters, wind turbines) · mechanical systems (strain-actuated solar arrays, vehicle suspensions) · electrical systems (analog filter circuits, power converters) · thermal systems (aircraft air cycle machines, management networks)

Research Experience

5/2016–7/2016 *Simulation & Analysis Intern*, Deere & Company, focusing on battery modeling and systems engineering projects.

5/2015–8/2015 *Simulation & Analysis Intern*, Deere & Company, researched methods to solve complex system architecture design problems focusing on hybrid powertrains and active suspensions.

1/2013–12/2017 *Graduate Research Assistant*, Dept. of Industrial and Enterprise Systems Engineering, UIUC, appointment to work on various research projects.

1/2012–1/2014 *Research Intern*, John Deere Technology Innovation Center, Champaign, IL, developed a discrete event simulation of large-scale agricultural operations using MATLAB, SIMULINK, and R linked with agricultural environment simulations.

12/2011–07/2019 *Member*, Engineering System Design Lab, UIUC.

Teaching Experience

FA2020 *SYSE* 567: *Systems Engineering Architecture*—Instructor, CSU.

SP2020 *ENGR* 667: *Advanced Model-Based Systems Engineering*—Co-instructor, CSU.

Honors and Awards

8/2016 *List of Teachers Ranked as Excellent by Their Students Spring* 2016, based on student evaluations for position as a GE 312 teaching assistant.

5/2015 *JPL Research Poster Conference Award*, co-author on poster titled "Strain Actuation & Sensing of SC Structures for Payload Jitter Suppression and Momentum Dumping" presented at the Jet Propulsion Laboratory Research and Development poster session on Nov. 12, 2014.

4/2015 *Mavis Future Faculty Fellow*, selected as a MF3 Fellow for 2015–2016 whose program is designed to help doctoral students in the College of Engineering become the next generation of great engineering faculty.

4/2013 *ISE Service Award*, given to recognize students who demonstrate leadership and commitment to the Dept. of Industrial and Enterprise Systems Engineering, UIUC.

8/2012 *Best Technological Innovation*, given to an intern for the best technological innovation at the Research Park at UIUC, project with John Deere Technology Innovation Center.

Service and Leadership

8/2018–2019 *Session co-organizer* for Active System Design, ASME International Design Engineering Technical Conferences.

7/2014 *College for Kids Kamp Kaboom—Mechanics of Trebuchets*, helped organize and run a 6 hour event demonstrating engineering principles to elementary school students.

4/2013–2017 *Junior Scientist Day—Mechanics of Trebuchets*, helped organize and run a science fair-like exhibit demonstrating engineering principles to elementary school students using trebuchets.

3/2013–2014 *Engineering Open House—Mechanics of Trebuchets*, helped organize and run a science fair exhibit demonstrating engineering principles to K-12 students.

Fall 2012–2014 *GE* 100—*Student Helper*, Dept. of Industrial and Enterprise Systems Engineering, UIUC, assisted with the design and instruction of trebuchet introductory project.

4/2012–Present *Peer Reviewer*, performed reviews for various journals and conference proceedings including:

ASME: Journal of Mechanical Design, International Design Engineering Technical Conferences, International Mechanical Engineering Congress and Exposition; *AIAA*: AIAA Journal, Journal of Thermophysics and Heat Transfer; *IEEE*: Transactions on Transportation Electrification, IEEE Access; *MDPI*: Actuators, Applied Sciences, Electronics, Energies, Processes, Sustainability; *Elsevier*: Aerospace Science and Technology, Computer-Aided Design; *Other*: Optics Express, Optimization and Engineering

Professional Memberships

3/2012–Present American Society of Mechanical Engineers, Member

8/2012–Present American Institute of Aeronautics and Astronautics, Member

8/2020–Present International Council on Systems Engineering, Associate Member

Profiles

- *Google Scholar*, 330 citations, url: [danielherber.com/links/google-scholar]
- *ResearchGate*, url: [danielherber.com/links/researchgate]
- *Publons*, url: [danielherber.com/links/publons]
- *GitHub*, url: [danielherber.com/links/github]
- *Matlab Central*, url: [danielherber.com/links/matlab-central]
- *LinkedIn*, url: [danielherber.com/links/linkedin]
- *ORCID* (0000-0003-4995-7375), url: [danielherber.com/links/orcid]
- *CSU Systems Engineernig*, url: [danielherber.com/links/csu-se]

Media

- Faculty Friday: Dan Herber (https://www.engr.colostate.edu/se/2020/06/12/faculty-friday-dan-herber/)
- CAPSat: Undergrad students prepare to launch a satellite (http://ise.illinois.edu/newsroom/article/capsat)
- Dan Herber wins Mavis Future Faculty Fellow (http://ise.illinois.edu/newsroom/article/dan-herber-wins-mavis-future-faculty-fellow)
- ISE Graduate Student Dan Herber: Multidisciplinary Optimization (https://ise.illinois.edu/newsroom/newsletters/pdfs/ISE-annual-report2014.pdf#page=16)
- Interns have much to gain at Research Park (https://dailyillini.com/uncategorized/2012/08/23/interns-have-much-to-gain-at-research-park/)
- Research Park honors most valuable interns of 2012 (http://www.researchpark.illinois.edu/news/research-park-honors-most-valuable-interns-2012)

Publications—Upcoming

* DR Herber and AK Sundarrajan, *On the uses of linear-quadratic methods in solving nonlinear dynamic optimization problems with direct transcription*, (to appear) ASME International Mechanical Engineering Congress & Exposition, Portland, OR, USA, Nov. 2020

* YH Lee, DR Herber, and JT Allison, *Simulation and optimization of linear viscoelasticity in the time domain using approximate linear time-invariant state-space models*, (extended abstract submitted to) 2020 International Congress of Theoretical and Applied Mechanics

Publications—Journal Articles

$\mathcal{J}7$ DR Herber and JT Allison, "A problem class with combined architecture, plant, and control design applied to vehicle suspensions," *ASME Journal of Mechanical Design*, vol. 141, no. 10, p. 101 401, Oct. 2019. doi: 10.1115/1.4043312,
https://systemdesign.illinois.edu/publications/Herber2019b.pdf

$\mathcal{J}6$ SRT Peddada, DR Herber, HC Pangborn, AG Alleyne, and JT Allison, "Optimal flow control and single split architecture exploration for fluid-based thermal management," *ASME Journal of Mechanical Design*, vol. 141, no. 8, p. 083 401, Aug. 2019. doi: 10.1115/1.4043203,
https://systemdesign.illinois.edu/publications/Peddada2019a.pdf

$\mathcal{J}5$ DR Herber and JT Allison, "Nested and simultaneous solution strategies for general combined plant and control design problems," *ASME Journal of Mechanical Design*, vol. 141, no. 1, p. 011 402, Jan. 2019. doi: 10.1115/1.4040705,
https://systemdesign.illinois.edu/publications/Herber2019a.pdf

$\mathcal{J}4$ CM Chilan, DR Herber, YK Nakka, SJ Chung, JT Allison, JB Aldrich, and OS Alvarez-Salazar, "Co-design of strain-actuated solar arrays for spacecraft precision pointing and jitter reduction," *AIAA Journal*, vol. 55, no. 9, pp. 3180–3195, Sep. 2017. doi: 10.2514/1.J055748,
https://systemdesign.illinois.edu/publications/Chilan2017a.pdf

$\mathcal{J}3$ DR Herber, T Guo, and JT Allison, "Enumeration of architectures with perfect matchings," *ASME Journal of Mechanical Design*, vol. 139, no. 5, p. 051 403, May 2017. doi: 10.1115/1.4036132,
https://systemdesign.illinois.edu/publications/Her17a.pdf

$\mathcal{J}2$ DR Herber, AP Deshmukh, ME Mitchell, and JT Allison, "Project-based curriculum for teaching analytical design to freshman engineering students via reconfigurable trebuchets," *Education Sciences*, vol. 6, no. 1, Feb. 2016. doi: 10.3390/educsci6010007,
https://systemdesign.illinois.edu/publications/Her16a.pdf

$\mathcal{J}1$ JT Allison and DR Herber, "Multidisciplinary design optimization of dynamic engineering systems," *AIAA Journal*, vol. 52, no. 4, pp. 691–710, Apr. 2014. doi: 10.2514/1.J052182,
https://systemdesign.illinois.edu/publications/All14a.pdf
—Special Section on Multidisciplinary Design Optimization—

Publications—Conference Proceedings

$C17$ DR Herber, "Enhancements to the perfect matching approach for graph enumeration-based engineering challenges," in *ASME International Design Engineering Technical Conferences*, Aug. 2020,
https://www.engr.colostate.edu/~drherber/files/Herber2020b.pdf

$C16$ DR Herber, JT Allison, R Buettner, P Abolmoali, and SS Patnaik, "Architecture generation and performance evaluation of aircraft thermal management systems through graph-based techniques," in *AIAA Science and Technology Forum and Exposition*, Orlando, FL, USA, Jan. 2020. doi: 10.2514/6.2020-0159,
https://www.engr.colostate.edu/~drherber/files/Herber2020a.pdf

$C15$ T Guo, DR Herber, and JT Allison, "Circuit synthesis using generative adversarial networks (GANs)," in *AIAA Science and Technology Forum and Exposition*, San Diego, CA, USA, Jan. 2019. doi: 10.2514/6.2019-2350,
https://systemdesign.illinois.edu/publications/Guo2019a.pdf
—Invited Paper—

$C14$ T Guo, DR Herber, and JT Allison, "Reducing evaluation cost for circuit synthesis using active learning," in *ASME International Design Engineering Technical Conferences*, Québec City, Canada, Aug. 2018, V02AT03A011. doi: 10.1115/DETC2018-85654,
https://systemdesign.illinois.edu/publications/Guo2018d.pdf

$C13$ SRT Peddada, DR Herber, HC Pangborn, AG Alleyne, and JT Allison, "Optimal flow control and single split architecture exploration for fluid-based thermal management," in *ASME International Design Engineering Technical Conferences*, Québec City, Canada, Aug. 2018, V02AT03A005. doi: 10.1115/DETC2018-86148,
https://systemdesign.illinois.edu/publications/Peddada2018a.pdf

$C12$ DR Herber and JT Allison, "A problem class with combined architecture, plant, and control design applied to vehicle suspensions," in *ASME International Design Engineering Technical Conferences*, Québec City, Canada, Aug. 2018, V02AT03A006. doi: 10.1115/DETC2018-86213,
https://systemdesign.illinois.edu/publications/Her18a.pdf

*C*11 C Lin, DR Herber, Vedant, YH Lee, A Ghosh, RH Ewoldt, and JT Allison, "Attitude control system complexity reduction via tailored viscoelastic damping co-design," in *AAS Guidance & Control Conference*, Breckenridge, CO, USA, Feb. 2018,
https://systemdesign.illinois.edu/publications/Lin2018a.pdf

*C*10 DR Herber and JT Allison, "Unified scaling of dynamic optimization design formulations," in *ASME International Design Engineering Technical Conferences*, Cleveland, OH, USA, Aug. 2017, V02AT03A003. doi: 10.1115/DETC2017-67676,
https://systemdesign.illinois.edu/publications/Her17c.pdf

*C*9 DR Herber and JT Allison, "Nested and simultaneous solution strategies for general combined plant and controller design problems," in *ASME International Design Engineering Technical Conferences*, Cleveland, OH, USA, Aug. 2017, V02AT03A002. doi: 10.1115/DETC2017-67668,
https://systemdesign.illinois.edu/publications/Her17b.pdf

*C*8 DR Herber, T Guo, and JT Allison, "Enumeration of architectures with perfect matchings," in *ASME International Design Engineering Technical Conferences*, Charlotte, NC, USA, Aug. 2016, V02AT03A005. doi: 10.1115/DETC2016-60212,
https://systemdesign.illinois.edu/publications/Her16b.pdf

*C*7 CM Chilan, DR Herber, YK Nakka, SJ Chung, JT Allison, JB Aldrich, and OS Alvarez-Salazar, "Co-design of strain-actuated solar arrays for precision pointing and jitter reduction," in *AIAA Science and Technology Forum and Exposition*, San Diego, CA, USA, Jan. 2016. doi: 10.2514/6.2016-0162,
https://systemdesign.illinois.edu/publications/Chi16a.pdf

*C*6 JT Allison, DR Herber, and AP Deshmukh, "Integrated design of dynamic sustainable energy systems," in *International Conference on Engineering Design*, vol. 1, Milan, Italy, Jul. 2015, pp. 299–308,
https://systemdesign.illinois.edu/publications/All15a.pdf

*C*5 AP Deshmukh, DR Herber, and JT Allison, "Bridging the gap between open-loop and closed-loop control in co-design: A framework for complete optimal plant and control architecture design," in *American Control Conference*, Chicago, IL, USA, Jul. 2015, pp. 4916–4922. doi: 10.1109/ACC.2015.7172104,
https://systemdesign.illinois.edu/publications/Des15a.pdf

*C*4 DR Herber, JW McDonald, OS Alvarez-Salazar, G Krishnan, and JT Allison, "Reducing spacecraft jitter during satellite reorientation maneuvers via solar array dynamics," in *AIAA/ISSMO Multidisciplinary Analysis and Optimization Conference*, Atlanta, GA, USA, Jun. 2014, pp. 1–17. doi: 10.2514/6.2014-3278,
https://systemdesign.illinois.edu/publications/Her14c.pdf

*C*3 DR Herber and JT Allison, "Wave energy extraction maximization in irregular ocean waves using pseudospectral methods," in *ASME International Design Engineering Technical Conferences*, Portland, OR, USA, Aug. 2013, V03AT03A018. doi: 10.1115/DETC2013-12600,
https://systemdesign.illinois.edu/publications/Her13a.pdf
—Nominated as a Paper of Distinction—

*C*2 JT Allison and DR Herber, "Multidisciplinary design optimization of dynamic engineering systems," in *AIAA Multidisciplinary Design Optimization Specialist Conference*, Boston, MA, USA, Apr. 2013, pp. 1–30. doi: 10.2514/6.2013-1462,
https://systemdesign.illinois.edu/publications/All13a.pdf

*C*1 JT Allison, A Kaitharath, and DR Herber, "Wave energy extraction maximization using direct transcription," in *ASME International Mechanical Engineering Congress and Exposition*, Houston, TX, USA, Nov. 2012, pp. 485–495. doi: 10.1115/IMECE2012-86619,
https://systemdesign.illinois.edu/publications/All12c.pdf

Publications—Other

$\mathcal{O}6$ DR Herber and JT Allison, "Approximating arbitrary impulse response functions with Prony basis functions," Engineering System Design Lab, Urbana, IL, USA, Technical Report UIUC-ESDL-2019-01, Oct. 2019. url: http://hdl.handle.net/2142/106010, https://systemdesign.illinois.edu/publications/Herber2019c.pdf

$\mathcal{O}5$ DR Herber, "Advances in combined architecture, plant, and control design," Ph.D. Dissertation, University of Illinois at Urbana-Champaign, Urbana, IL, USA, Dec. 2017. url: http://hdl.handle.net/2142/99394, https://systemdesign.illinois.edu/publications/Her17e.pdf

$\mathcal{O}4$ DR Herber and JT Allison, "Enhancements to the perfect matching-based tree algorithm for generating architectures," Engineering System Design Lab, Urbana, IL, USA, Tech. Rep. UIUC-ESDL-2017-02, Dec. 2017. url: http://hdl.handle.net/2142/98990, https://systemdesign.illinois.edu/publications/Her17d.pdf

$\mathcal{O}3$ DR Herber, "Basic implementation of multiple-interval pseudospectral methods to solve optimal control problems," Engineering System Design Lab, Urbana, IL, USA, Technical Report UIUC-ESDL-2015-01, Jun. 2015. url: http://hdl.handle.net/2142/77888, https://systemdesign.illinois.edu/publications/Her15a.pdf

$\mathcal{O}2$ DR Herber, "Solving optimal control problems using simscape models for state derivatives," Engineering System Design Lab, Urbana, IL, USA, Technical Report UIUC-ESDL-2014-01, Jul. 2014. url: http://hdl.handle.net/2142/50015, https://systemdesign.illinois.edu/publications/Her14b.pdf

$\mathcal{O}1$ DR Herber, "Dynamic system design optimization of wave energy converters utilizing direct transcription," M.S. Thesis, University of Illinois at Urbana-Champaign, Urbana, IL, USA, May 2014. url: http://hdl.handle.net/2142/49463, https://systemdesign.illinois.edu/publications/Her14a.pdf

Presentations

$\mathcal{P}2$ DR Herber and JT Allison, "Control co-design: Achieving new functionality and performance via integrated physical and control system design," in *ASME International Design Engineering Technical Conferences*, DETC2020-19184, Aug. 2020, https://www.engr.colostate.edu/~drherber/files/Herber2020c.pdf

$\mathcal{P}1$ JT Allison and DR Herber, "Control co-design: Achieving new functionality and performance via integrated physical and control system design," in *ASME International Mechanical Engineering Congress & Exposition*, IMECE2019-13707, Salt Lake City, UT, USA, Nov. 2019, https://systemdesign.illinois.edu/publications/Allison2019a.pdf

Invited Talks

2020 "Control co-design direct transcription solution strategies: Overview and challenges," *NSF IDADS Online Workshop*, Mar. 26. https://www.engr.colostate.edu/~drherber/files/IDADS-Herber.pdf

2019 "Challenges and methods for the integrated design of dynamic engineering systems through system architecture synthesis and control co-design," *NREL's Flatirons Campus*, Oct. 31.