

Benjamin J. Davis

Professor of Chemical Engineering • The Cooper Union for the Advancement of Science and Art

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Education

Ph.D. in Chemical and Biomolecular Engineering June 2009

University of California at Los Angeles (Los Angeles, CA)

Ph.D. Thesis title: *“Global Optimization Techniques for Chemical Process Network Synthesis”*

B.S. in Chemical and Biomolecular Engineering May 2002

Cornell University (Ithaca, NY)

Professional Experience

Professor 2020 – present

The Cooper Union for the Advancement of Science and Art (New York, NY)

Associate Professor 2016 – 2020

The Cooper Union for the Advancement of Science and Art (New York, NY)

Assistant Professor 2009 – 2015

The Cooper Union for the Advancement of Science and Art (New York, NY)

Teaching Experience

Assistant, Associate, and Full Professor 2009 – present

The Cooper Union for the Advancement of Science and Art (New York, NY)

- ChE221: Material and Energy Balances (2018-20)
- ChE162/371/372: Chemical Engineering Laboratory I and II (2013, 2016, 2017)
- ChE161.2/382: Process Evaluation and Chemical Systems Design II (2011-16, 2019-20)
- ChE/EID488: Convex Optimization Techniques (2010 – present, 10 semesters)
- ChE421: Advanced Chemical Reaction Engineering (2010 – present, 10 semesters)
- ChE151/352: Process Simulation and Mathematical Techniques for ChEs (2010-17, 2019-20)
- ChE142/351: Separation Process Principles (2009-2016)
- ChE/EID447: Sustainability and Pollution Prevention (2009-present, 9 semesters)

Teaching Assistant - Pollution Prevention Spring 2005, 2006, 2007, 2008

University of California at Los Angeles (Los Angeles, CA)

Teaching Assistant - Process Economics and Analysis Winter 2005, 2006, 2007, 2008

University of California at Los Angeles (Los Angeles, CA)

Teaching Assistant - Cryogenics and Low-Temperature Processes Fall 2004, 2005, 2006

University of California at Los Angeles (Los Angeles, CA)

Teaching Assistant - Computer-Aided Chemical Process Design Spring 2004, 2007

University of California at Los Angeles (Los Angeles, CA)

Masters Students Supervised

- Sun Kim, ME '20, The Cooper Union – masters thesis on Sustainable Biojet Fuel Production from Salicornia (Fall 2018 – present)
- Chae Jeong, ME '18, The Cooper Union – masters thesis on “Economic and Environmental Evaluation of Olive Mill Wastewater Treatment Methods for a Self-Supplied American Olive Oil Mill” (Fall 2016 – Spring 2018)
- Kenneth O'Neill, ME '18, The Cooper Union – masters thesis on “Oxidative Coupling of Methane on Nanowire Catalysts: Synthesis of a Separation Train for OCM Reactor Effluent” (Fall 2016 – Spring 2018)
- Norris Nakagaki, ME '14, The Cooper Union – masters thesis on “Optimizing Batch and Fed-Batch 4-Chlorophenol Treatment Processes” (Fall 2012 – Spring 2014)
- Jung Choi, ME '13, The Cooper Union – masters thesis on “Green Chemical Engineering: Case studies on achieving sustainability in chemical process design” (Fall 2011 – Spring 2013)
- Heejae Huh, ME '13, The Cooper Union – masters thesis on “Sustainable Development of Shale Gas and Gas-to-Propylene” (Fall 2011 – Spring 2013)
- James Lee, ME '13, The Cooper Union – masters thesis on “Local Astaxanthin: The design and economics of a small-scale microalgal facility to produce a natural dietary supplement for an urban market” (Fall 2010 – Spring 2013)

Independent Study Students Supervised

- Amy Pan '20 – independent study project on cross-metathesis of fatty acid methyl esters with 1-hexene for an enzymatic-oil-to-jet process (Fall 2019)
- Tushar Nichakawade, ME '20 – independent study project on Evaluation of an Enzymatic-Oil-to-Jet Process for Converting Salicornia Bigelovii Seed Oil to Bio-aviation Fuel (Spring 2019)
- Irisa Llana BSE '22 – independent study project on optimal growing conditions for hydroponic farming of lettuce and basil (Spring 2019)
- Peter Zhao '20, The Cooper Union – independent study project on biorefinery design, economics, and environmental impact (Fall 2018 – Spring 2019)
- Sun Kim '18, The Cooper Union – independent study project on heat integration and minimum utility costs for an OCM plant (Fall 2016 – Fall 2018)
- Kenneth O'Neill '16, The Cooper Union – independent study project on process design for oxidative coupling of methane (Fall 2015 – Spring 2016)
- Henry Kasen '14, The Cooper Union – independent study project on identifying optimal games for three or more players (Summer 2012 – Fall 2012)
- Roy Kim '12, The Cooper Union – independent study project on the environmental impacts of ethylene carbonate production as a step in making polycarbonate (Summer 2011 – Fall 2011)
- Yosef Treitman '11 and James Baker '11, The Cooper Union – independent study project on developing an integer programming algorithm for Cooper Union scheduling (Spring 2011)
- Philip Wong '11, The Cooper Union – independent study project on a life-cycle assessment for bamboo v. aluminum v. steel bicycles (Fall 2010)
- Edwin Deleon '11, The Cooper Union – independent study project on modeling a chemical reactor for biomass pyrolysis for renewable energy generation (Spring 2010)
- James Stevenson '11, The Cooper Union – independent study project on assessment of the environmental and social impacts of mass transit systems in the U.S. (Fall 2009 – Fall 2010)

Research Publications

Davis, B. J. "Time on Task as an Assessment Tool for Student Learning." *Chemical Engineering Education* (in preparation).

Lin, K.; Sherman, J.; Davis, B.J.; Simson, A. "Optimization of Steam and CO₂ Recycle and Energy Use in a Modified BECCS Process." *Proceedings Computing and Systems Technology Division*, AIChE Annual Meeting, San Francisco, California, November 2020.

Zhao, P.; Chun, D.; Davis, B.J.; Simson, A. "*Miscanthus Sacchariflorus* Bioenergy Production." *Proceedings Sustainable Engineering Forum*, AIChE Annual Meeting, Orlando, Florida, November 2019.

Jeong, C.; Davis, B. J. "Economic and Environmental Evaluation of Olive Mill Wastewater Treatment Methods for a Self-Supplied American Olive Oil Mill." *Proceedings Environmental Division*, AIChE Annual Meeting, Minneapolis, Minnesota, November 2017.

O'Neill, K.; Davis, B. J. "Economic and Environmental Assessment of Methane to Ethylene Via Oxidative Coupling." *Proceedings Topical Conference: Innovations of Green Process Engineering for Sustainable Energy and Environment*, AIChE Annual Meeting, San Francisco, California, November 2016.

Davis, B. J. "Time on Task as an Assessment Tool for Student Learning." *Proceedings Education Division*, AIChE Annual Meeting, Minneapolis, Minnesota, October 2011.

Davis, B. J. "Chemical Engineering in the 8th Grade Classroom." *Proceedings Education Division*, AIChE Annual Meeting, Nashville, Tennessee, November 2009.

Phillis, Y. A., Davis, B. J. "Assessment of Corporate Sustainability via Fuzzy Logic." *Journal of Intelligent and Robotic Systems* 55 (1) p. 3 – 20, 2009.

Davis, B. J., Taylor, L. A., Manousiouthakis, V. I. "Identification of the Attainable Region for Batch Reactor Networks." *Industrial & Engineering Chemistry Research* 47 (10) p. 3388 – 3400, 2008.

Davis, B. J.; Berens, B.; Manousiouthakis, V. I. "Dynamic Operation of a 1.2 kW PEM Fuel Cell." *Proceedings Computing and Systems Technology Division*, p. 6616-6619, AIChE Annual Meeting, Cincinnati, Ohio, November 2005.

Davis, B. J.; Manousiouthakis, V. I. "Application of Primal-Dual Iteration to the Solution of Process Network Synthesis Problems." *Proceedings Computing and Systems Technology Division*, p. 6874-6878, AIChE Annual Meeting, Cincinnati, Ohio, November 2005.

Presentations

Lin, K.; Sherman, J.; Davis, B.J.; Simson, A. "Optimization of Steam and CO₂ Recycle and Energy Use in a Modified BECCS Process." Presented at the AIChE Annual Meeting, paper 554f, San Francisco, California, November 2020.

Zhao, P.; Chun, D.; Davis, B.J.; Simson, A. "*Miscanthus Sacchariflorus* Bioenergy Production." Presented at the AIChE Annual Meeting, paper 695c, Orlando, Florida, November 2019.

- Davis, B. J. "Scientific Computing for Chemical Engineers in Python." Presented at the AIChE Annual Meeting, paper 97f, Orlando, Florida, November 2019.
- Davis, B. J. "Introduction to Personal Finance." Presented to ESC000 in Rose Auditorium, New York, New York, March 2019.
- Jeong, C.; Davis, B. J. "Economic and Environmental Evaluation of Olive Mill Wastewater Treatment Methods for a Self-Supplied American Olive Oil Mill." Presented at the AIChE Annual Meeting, paper 521b, Minneapolis, Minnesota, November 2017.
- Davis, B. J. "Robert's Rules of Order: How to Get Things Done When You're in Charge of a Group." Presented to ESC000 in Rose Auditorium, New York, New York, January 2017.
- O'Neill, K.; Davis, B. J. "Economic and Environmental Assessment of Methane to Ethylene Via Oxidative Coupling." Presented at the AIChE Annual Meeting, paper 70a, San Francisco, California, November 2016.
- Davis, B. J. "Robert's Rules of Order: How to Get Things Done at a Meeting." Presented to ESC000 in Rose Auditorium, New York, New York, April 2016.
- Bayles, T. et al. "Getting Started in Engineering Education Research" (invited panelist) Presented at the AIChE Annual Meeting, paper 412, Atlanta, Georgia, November 2014.
- Leppek et al. "The Teaching of Transport Phenomena and Related Courses: Survey Results" Presented at the AIChE Annual Meeting, paper 372786, Atlanta, Georgia, November 2014.
- Anderson, T. J. et al. "Electives in the Undergraduate Chemical Engineering Curriculum" Presented at the AIChE Annual Meeting, paper 574a, San Francisco, California, November 2013.
- Huh, H. and Davis, B. J. "Gas to Olefins: Sustainable Development of Shale Gas?" Presented at the AIChE Annual Meeting, paper 764e, San Francisco, California, November 2013.
- Davis, B. J. "Time on Task as an Assessment Tool for Student Learning." Presented at the AIChE Annual Meeting, paper 372h, Minneapolis, Minnesota, October 2011.
- Davis, B. J. "What is Chemical Engineering?" Presented at Stuyvesant High School to junior and senior Physics research students, room 815, New York, New York, May 2011.
- Davis, B. J. "Project-Based Learning for Sustainability and Life-Cycle Assessment." Presented at the AIChE Annual Meeting, paper 405d, Salt Lake City, Utah, November 2010.
- Davis, B. J. "Chemical Engineering in the 8th Grade Classroom." Presented at the AIChE Annual Meeting, paper 32c, Nashville, Tennessee, November 2009.
- Davis, B. J.; Phillis, Y. A. "Fuzzy Assessment of Corporate Sustainability." Presented at the AIChE Annual Meeting, paper 713c, Philadelphia, Pennsylvania, November 2008.

Manousiouthakis, V. I.; Davis, B. J. “Performance Targets for Batch Wastewater Treatment Operations.” Presented at the AIChE Annual Meeting, paper 86b, Philadelphia, Pennsylvania, November 2008.

Davis, B. J.; Manousiouthakis, V. I. “Optimization of Hydrogen Liquefaction Networks.” Presented at the AIChE Annual Meeting, paper 296b, Salt Lake City, Utah, November 2007.

Davis, B. J.; Manousiouthakis, V. I. “Automatic Construction of Globally Optimal Power Cycle Networks.” Presented at the AIChE Annual Meeting, paper 176d, Salt Lake City, Utah, November 2007.

Davis, B. J.; Manousiouthakis, V. I. “Attainable Region Construction for Reactor Networks Exhibiting Limit Cycles.” Presented at the AIChE Annual Meeting, paper 460g, San Francisco, California, November 2006.

Davis, B. J.; Manousiouthakis, V. I. “Faster Methods for Solving Large Quadratic Programs.” Presented at the AIChE Annual Meeting, paper 617e, San Francisco, California, November 2006.

Davis, B. J.; Manousiouthakis, V. I. “Dynamic Operation of a 1.2 kW PEM Fuel Cell.” Presented at the AIChE Annual Meeting, paper 314d, Cincinnati, Ohio, November 2005.

Davis, B. J.; Manousiouthakis, V. I. “Application of Primal-Dual Iteration to the Solution of Process Network Synthesis Problems.” Presented at the AIChE Annual Meeting, paper 445e, Cincinnati, Ohio, November 2005.

Davis, B. J.; Manousiouthakis, V. I. “PEM Fuel Cell Network Optimization.” Presented at the AIChE Annual Meeting, paper 26c, Austin, Texas, November 2004.

Davis, B. J.; Manousiouthakis, V. I. “Modeling of a Single Non-Isothermal Fuel Cell Stack.” Presented at the AIChE Annual Meeting, paper 514d, Austin, Texas, November 2004.

Research Interests

- Pollution prevention in chemical and energy generation processes
- Sustainable chemical and bioproduct process design
- Performance targets for batch processes and wastewater treatment
- Economics of CO₂ capture and sequestration
- Engineering education (economics, evaluation, and assessment)
- Life-cycle and sustainability assessment
- Convex optimization theory (algorithms, vector space methods, applications to networks)
- Numerical methods and scientific computing in Python
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Service and Leadership Experience

The Cooper Union for the Advancement of Science and Art Committee Member , Academic Standards Committee	September 2016 – present
Committee Member , Menschel Fellowship Committee	April 2016, 2018 – present
Chair , Working Group on Standard 5 for MSCHE accreditation	April 2016 – April 2017

Chair , “Working Group”, Academic Opportunities Sub-committee	Oct 2013 – January 2014
Council Member , Institutional Review Board (IRB)	January 2013 – present
Chair , Planning and Assessment Council	Oct 2012 – April 2017
Chair , Ad Hoc Communications Committee	Aug 2012 – Nov 2012

Professional Affiliations

American Institute of Chemical Engineers, Education Division Chair (elected position)	November 2019 – present
American Institute of Chemical Engineers, Education Division Vice-Chair (elected position)	November 2017 – November 2019
American Institute of Chemical Engineers Senior Member	January 2017 – present
Association of Energy Engineers Member and Student Chapter Advisor	December 2016 – present
American Institute of Chemical Engineers, Education Division 2nd Vice-Chair (elected position)	September 2015 – November 2017
American Institute of Chemical Engineers Annual Meeting (San Francisco, CA) Co-chair , “Issues and Challenges in Teaching Chemical Process Design” and “Survey Results and Best Practices: Electives”	November 2013
American Institute of Chemical Engineers Annual Meeting (Pittsburgh, PA) Co-chair , “Best Practices in Senior Design Courses by Adjuncts” and “Faculty and Best Papers From CEE and the ASEE Proceedings”	October 2012
American Institute of Chemical Engineers, Education Division Secretary / Treasurer (elected position)	September 2011 – September 2015
American Institute of Chemical Engineers Annual Meeting (Salt Lake City, UT) Co-chair , “Incorporating Green Eng. and Sustainability Into the Curriculum”	November 2010

American Institute of Chemical Engineers Annual Meeting (Nashville, TN) Co-chair , “Dynamics, Design and Control of Sustainable Processes and Technologies and Associated Waste Management Principles”	November 2009
American Institute of Chemical Engineers Member	November 2004 – December 2016

Honors and Awards

Elected to the “Student's List” by Cooper Union Engineering Student Council	Fall 2011
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Fellowships and Grants

Cooper Union Grant Program Sustainable Salicornia: Hydroponic Farming for Bioproducts	2019
University of California at Los Angeles / Culver City Middle School UCLA SEE-LA GK-12 Teaching Fellowship	2008 – 2009
American Institute of Chemical Engineers 2008 CAST Graduate Travel Grant	November 2008