Jacob (Jack) Brouwer, Ph.D.
Associate Professor: Mechanical & Aerospace Engineering, Civil & Environmental Engineering
Associate Director: Advanced Power and Energy Program, National Fuel Cell Research Center
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Education and Training:

Institution	Major	Degree	Year
University of California, Irvine	Mechanical Engineering	B.S.	1987
University of California, Irvine	Mechanical Engineering	M.S.	1989
Massachusetts Institute of Technology	Mechanical Engineering	Ph.D.	1993

Research and Professional Experience:

7/13 – present **Associate Professor, Mechanical and Aerospace Engineering, Civil and Environmental Engineering, UC Irvine**
Tenured member of regular faculty responsible for educating graduate and undergraduate students, leading and supporting regular department, school, university and community service, and conducting independent research in high temperature electrochemical dynamics, fuel cells, electrolyzers, gas turbines, hybrid fuel cell gas turbine, and battery systems, hydrogen, electricity and heat tri-generation, fuel processing and integration, renewable power systems dynamics, and air quality and greenhouse gas impacts of future energy conversion and storage technologies in Mechanical and Aerospace Engineering and in Civil and Environmental Engineering.

8/97 – present **Associate Director, National Fuel Cell Research Center, UC Irvine**
Direct and conduct fuel cell, fuel cell gas turbine hybrid, fuel cell systems and components, micro-turbine, and advanced power generation technology research, development and demonstration activities. Lead the development of experimental and simulation capabilities for investigation of fuel cells and other advanced power and energy technologies. Take overall responsibility for the operations of the center including external relations, project management, faculty liaison, and supervision of technical and administrative staff. Develop curricula and instruct students in the fundamental science and technology of fuel cells. Develop the NFCRC concept in cooperation with the insight and leadership of Professor Scott Samuelsen and work cooperatively with other colleagues demonstrating technical expertise in fields related to fuel cells and advanced alternative energy conversion devices.

7/11 – 6/13 **Assistant Professor, Mechanical and Aerospace Engineering, Civil and Environmental Engineering, UC Irvine**
Non-tenured member of regular faculty responsible for the education of graduate and undergraduate students in Mechanical and Aerospace Engineering and in Civil and Environmental Engineering, development of curricula, teaching of courses in thermo-fluid sciences, mentoring of graduate students, garnering and servicing of research contracts and grants.

7/08 – 6/11 **Adjunct Associate Professor, Mechanical and Aerospace Engineering, UC Irvine**

Lead regular classroom instruction, co-supervise graduate students, and conduct independent research in dynamic simulation, hydrogen and electricity co-production, fuel cell systems analyses, novel solid oxide fuel cell materials science, and air quality and greenhouse gas impacts of future energy infrastructure.

6/04 – 6/08 **Adjunct Assistant Professor, Mechanical and Aerospace Engineering, UC Irvine**

Lead regular classroom instruction, co-supervise graduate students, and conduct independent research in dynamic simulation, hydrogen and electricity co-production, aerospace fuel cell systems, and related fuel cell science.

7/96 – 7/97 **R&D Program Manager, Reaction Engineering International**

Managed and led the design, development, construction and operation of the University Combustion Research Center (UCRC), a new center for combustion research at the University of Utah. Managed and performed computational fluid dynamic (CFD) analyses of combustion and other systems with reacting and/or multi-phase flow. Developed and applied advanced chemically reacting flow computational strategies for simulating pollutant emissions and emissions reduction strategies for combustion energy conversion systems.

6/93 – 7/97 **Research Assistant Professor, Mechanical Engineering, University of Utah**

Investigated the effects of turbulent mixing and the presence of chlorine on combustion efficiency, reaction stability, and product distribution through experiments in jet-stirred and plug flow reactors and detailed theoretical modeling of turbulence and chemistry. Experiments used laser Rayleigh scattering and laser induced fluorescence (LIF).

1/93 - 5/93 **Post-Doctoral Researcher, Chemical Engineering Department, M.I.T.**

Advanced and applied lithium lamp method for measurement of hydroxyl radicals in a plug flow reactor.

9/89 - 12/92 **Research Assistant, Chemical Engineering Department, M.I.T.**

Investigated the effects of turbulent mixing and the presence of chlorine on combustion efficiency, reaction stability, and product distribution through experiments in jet-stirred and plug flow reactors and detailed theoretical modeling of turbulence and chemistry. Experiments used laser Rayleigh scattering and laser induced fluorescence (LIF).

6/91 - 9/91 **Staff Scientist, Sandia National Laboratories, Livermore, California**

Developed and tested a turbulent reacting flow model that incorporates detailed chemical kinetics with Dr. Alan Kerstein.

Publications:

1. McLarty, Dustin, **Brouwer, Jacob**, and Samuelsen, Scott, Fuel cell–gas turbine hybrid system design part II: Dynamics and control, Journal of Power Sources, Vol. 254, pp. 126-136, 2014.
2. Flores, Robert J., Shaffer, Brendan P., **Brouwer, Jacob**, Dynamic Distributed Generation Dispatch Strategy for Lowering the Cost of Building Energy, Applied Energy, Volume 123, Pages 196-208, 15 June 2014.
3. Maton, Jean-Paul, Zhao, Li, and **Brouwer, Jacob**, Dynamic modeling of compressed gas energy storage to complement renewable wind power intermittency, International Journal of Hydrogen Energy, Volume 38, pp. 7867-7880, 2013.

4. McLarty, Dustin, **Brouwer, Jack**, and Samuelsen, Scott, A spatially resolved physical model for transient system analysis of high temperature fuel cells, International Journal of Hydrogen Energy, Volume 38, pp. 7935-7946, 2013.
5. Shaffer, Brendan P., and **Brouwer, Jacob**, Dynamic Model for Understanding Spatial Temperature and Species Distributions in Internal-Reforming Solid Oxide Fuel Cells, Journal of Fuel Cell Science and Technology, Vol. 9, pp. 041012-1– 041012-11, 2012.
6. Margalef, Pere, Brown, Tim, **Brouwer, Jacob**, Samuelsen, Scott, Conceptual design and configuration performance analyses of poly-generating high temperature fuel cells, International Journal of Hydrogen Energy, Volume 36, Issue 16, Pages 10044-10056, 2011.
7. Margalef, Pere, Brown, Tim, **Brouwer, Jacob**, and Samuelsen, Scott, Short communication: Efficiency of poly-generating high temperature fuel cells, Journal of Power Sources, Volume 196, Issue 4, Pages 2055-2060, 15 February 2011.
8. **Brouwer, Jacob**, On the role of fuel cells and hydrogen in a more sustainable and renewable energy future, Current Applied Physics, Volume 10, pp. S9-S17, 2010.
9. Mueller, F., Tarroja, B.J., Maclay, J.D., Jabbari, F., **Brouwer, J.**, and Samuelsen, G.S., Design, Simulation and Control of a 100 Megawatt Class Solid Oxide Fuel Cell Gas Turbine Hybrid System, Journal of Fuel Cell Science and Technology, Vol. 7, pp. 03107-1-11, 2010.
10. Mueller, Fabian, Jabbari, Faryar, **Brouwer, Jacob**, On the intrinsic transient capability and limitations of solid oxide fuel cell systems, Journal of Power Sources, Vol.187, pp. 452-460, 2009.

Synergistic Activities:

1. >15-years' experience studying the science & engineering of energy conversion, coupled mass, energy and momentum conservation, chemical and electrochemical reaction and heat transfer dynamics and thermodynamics.
2. Primary developer and mentor of students and post-doctoral researchers developing steady-state & dynamic physical models of the fundamental processes that govern energy conversion devices such as fuel cells, electrolyzers, batteries, and gas turbines.
3. Testing, experimentation, and evaluation experience with gas turbines, fuel cells, electrolyzers, PV and wind power systems including the world's first solid oxide fuel cell gas turbine hybrid system and the world's first high temperature fuel cell tri-generation system.
4. Developing and applying steady state and dynamic models for gas turbines, fuel cells, fuel cell systems and integrated solar and renewable systems in the Simulink^{TM} framework.
5. Led the establishment of National Fuel Cell Research Center and Advanced Power and Energy Program with Professor Scott Samuelsen supported by the U.S. Department of Energy, California Energy Commission, and at least 15 industrial partners.