

Anthony James Bowman, Ph.D.

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Summary of Experience

Over ten years experience as a mechanical engineer specializing in thermal systems and energy conversion equipment performance. My overall experience is a combination of research and development, academic endeavors, and industrial application of emerging technology in energy conversion equipment.

Chronological Summary of Experience:

- *Marquette University*:
 - Jan 2008 – present (Research Assistant Professor, current position)
 - Aug 2001 – Dec 2007 (Lecturer/Instructor)
 - June 1993 – May 1996 and Aug 1999 – Aug 2007 (FT, PT Student)
- *Siemens Power Corporation, Fossil Division*: May 1996 – Aug 1999
- *Cleaver-Brooks Company*: Jan 1994 – May 1996
- *NASA – Glenn Research Center*: Jan 1990 – Jan 1991; Summers 1991 & 1992

Academic Background

Marquette University, Milwaukee, Wisconsin

Ph.D., Mechanical Engineering, August, 2007

Dissertation Title: *Investigation of Laminar Fluid Flow and Heat Transfer in Coiled Tube Systems*

Major: Thermal Sciences and Energy Systems

Duties: Instructor, Research Manager, Research Assistant, Teaching Assistant

Master of Science in Mechanical Engineering, August 2001

Thesis Title: *Development of an Optimal Fan Selection Procedure Based on Modified Dimensionless Performance Correlations*

Major: Thermal Sciences and Energy Systems

Duties: Research Assistant, Teaching Assistant

University of Wisconsin Platteville, Platteville, Wisconsin

Bachelor of Science in Mechanical Engineering, December 1992

Major: Combustion, Thermal Sciences, Engine Design

Duties: Teaching Assistant, Computer Laboratory Supervisor

Gresham High School, Gresham, Wisconsin

Salutatorian, Class of 1986, National Army Scholar Athlete Award

Work Experience

Marquette University, College of Engineering, Milwaukee, WI

Research Assistant Professor

- Research Interest: Numerical and experimental research in Energy Systems – cycles and components
- Project Manager for the Thermal Fluid Science and Energy Research Center at Marquette University
- Responsible for the TSERC FTP-server and web-page management and maintenance
- Responsible for maintenance of computers in the TSERC numerical simulation laboratory
- Instructor of various undergraduate courses: dynamics, engineering economy, fluid dynamics, heat transfer, and thermodynamics.
- Co-Lecturer of Fluent training courses for students and industry guests
- Co-Lecturer of Heat Transfer and Fluid Mechanics training courses for students and industry guests
- Reviewer for the various sections of the Fundamentals and Professional Engineering Exam (FE & PE)
- Reviewer for the ASME Journal of Pressure Vessel Technology

Lecturer/Instructor

- Lecturer of undergraduate energy systems core courses – excellent evaluations
- Guest lecturer for the thermodynamics section of Fundamentals of Engineering exam review
- Co-Lecturer of Fluent training courses for students and industry guests

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- Assisted in design of heat exchanger experiments, sales support and efficiency software for Sentry Equipment Corporation
- Coordinated energy laboratory facility and resources for department energy faculty
- Primary CFD user/trainer for the College of Engineering at Marquette University

Research Assistant

- Researched optimization of component designs through minimization of entropy production, including boilers, fan design and various types of heat exchangers.
- Co-edited a technical report series for the Thermofluid Science and Energy Research Center.
- Investigated alternative fuel cell cogeneration scenarios to include the production of steam and electricity. Performed financial feasibility studies to suggest an investment threshold and rate of return.
- Improved Windows based software designed to analyze commonly used energy conversion equipment.
- Developed user's manual and technical documentation for sales support and efficiency software.
- Programmed efficiency and analysis software in Visual Basic and C++.

Teaching Assistant (Energy Conversion Processes Laboratory)

- Performed seven different experiments illustrating many fundamental thermodynamic principles of energy conversion including second law (exergy) analysis.
- Developed numerous computer programs to emphasize the fundamentals of the experiments rather than the many required calculations.
- Integrated error and sensitivity analysis with regard to energy systems into curriculum; applied these methods to determine statistical confidence in experimental data.
- Prepared additional lectures to further assist students with weak fundamentals understanding.
- Updated three laboratory experiments to incorporate data acquisition and data reduction and analysis.

Siemens Power Corporation, Fossil Division, Milwaukee, WI (Siemens Westinghouse Power Corporation)

A global leader in the manufacture of fossil power plants including conventional coal-fired steam power plants and advanced gas turbine simple-, combined- and cogeneration-power plants.

Net sales world wide over \$12 billion.

Thermal Performance Engineer

- Predicted thermal performance for simple, combined and cogeneration power plant performance requests.
- Assisted new project sales in negotiating performance guarantees on new projects.
- Assisted service sales in negotiating performance guarantees on gas turbine rebuild projects.
- Conducted field prototype testing and research for advanced premixed combustion chamber hardware, compressor design, turbine design and topping/bottoming cycle implementation.
- Conducted and directed performance and emissions testing for final contract guarantees.
- Diagnosed and tuned existing gas turbines resulting in significant increases in efficiency and output of simple- and combined-cycle power plants.
- Supervised two engineering technicians and \$200,000 of testing equipment.

1998 – General Managers Award for excellence in service and savings to the company in liquidated damages and performance bonuses.

Promoted from Engineer I to Engineer III (Senior Engineer) in two years.

Tour of duty in Hsin Ta, Taiwan as lead performance engineer (2400 MW combined cycle power plant).

Cleaver-Brooks Company, a Division of Aqua-Chem, Incorporated, Milwaukee, WI

An industry leader in the manufacture of scotch-marine type boilers, deaerators and other water treatment equipment. Annual gross sales of ~\$320 million.

Engineering Intern

- Optimized combustion air fan design and manufacture. Achieved an estimated annual savings of \$300,000 from the optimization.
- Assisted in research to reduce overall pressure drop through boiler and burner.

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- Developed an alternative front head insulation method. The new application resulted in reduced production time and maintained the Underwriters Laboratory listing.
- Developed an alternative manufacturing method for combustion air hood design, which resulted in a 20% decrease in manufacturing cost.
- Trained drafting personnel in 3-D parametric modeling software (Pro/E).

NASA, Glenn Research Center (formerly Lewis Research Center), Cleveland, OH

Research center specializing in the development and testing of propulsion technology (turbine, rocket, nuclear and electric), space power generation, wind tunnel and vacuum chamber experiments.

International Space Station Project (formerly Space Station Freedom)

A multinational project to develop and launch a permanent manned space station. The station would first serve as an orbiting laboratory, and eventually as support for manned moon exploration.

Research Engineering Intern, Power Facilities and Test Branch of the Operations Division

The responsibilities included the design update of high vacuum, cryogenic, and plasma test facilities for flight hardware.

- Assisted in the facility development for the Plasma Contactor Test – a device developed to provide a grounding mechanism for the space station via the controlled expression of ionized xenon gas.
- Participated in the operation and development of the Photovoltaic Array-Plasma Interaction Test.
- Assisted in the complete build-up of the Beta Gimbal Test Bed. The test involved the high torque and frequency oscillations of the joint in a simulated near-earth-orbit environment.
- Operated and maintained the Nickel-Hydrogen Battery Life Test facility (used in the Iridium satellite communications project).
- Supervised the complete build-up of the Roll Ring Test Bed. The roll ring provides a non-arcing, high-power electrical contact across a rotating joint.
- Participated in the refurbishment of the Space Propulsion Facility. The facility is the world's largest vacuum chamber. Updated the high vacuum oil diffusion pumps, the cryo-panels, and the repressurization system.
- Assisted in the build-up and operation of the Thermal Energy Storage Test Bed as part of the Solar Dynamics Project. Thermal energy storage was achieved utilizing the heat of solidification of a lithium salt.

Publication Record

Textbooks

Park, H., Bowman, A.J., Kim, K., Engineering Graphics, Design and Modeling with UGS NX6, 2009, McGraw-Hill, ISBN: 0-07-804094-9.

Gaggioli, R., Bowman, A.J., Paulus, D.M., Introductory Thermodynamics, {Project in process}.

Journal Papers (refereed)

Gaggioli, R.A., Richardson, D.H., Bowman, A.J., Paulus, D.M. Jr., “Available Energy: I. Gibbs Revisited, II. Gibbs Extended”, Proceedings of the Advanced Energy Systems Division, ASME, vol AES 39, pp. 285-296, 1999.

Bowman, A.J., Sekulic, D.P., “Surface Roughness and Thermodynamic Irreversibility in Fully Developed Turbulent Duct Flow, in Process, Enhanced and Multiphase Heat Transfer”, A Festschrift for A.E. Bergels, Bergell House, New York, pp. 405-411 (Also present as a lecture at the Arthur E. Bergles Symposium held at the Georgia Institute of Technology, November, 1996, Atlanta.)

Conference Papers (refereed)

Park, H., and Bowman, A.J., “Governing Equations Used in Coiled Tube Systems, Part I: Development of Standard/Generalized Forms,” Joint Conference of American Institute of Aeronautics and Astronautics and American Society of Mechanical Engineers, San Francisco, CA, AIAA2006-54577.

Park, H., and Bowman, A.J., “Governing Equations Used in Coiled Tube Systems, Part II: Order-of-Magnitude Analysis of Spiral Coil Systems,” Joint Conference of American Institute of Aeronautics and Astronautics and American Society of Mechanical Engineers, San Francisco, CA, AIAA2006-54581.

Park, H., Bowman, A.J., and Dake, T., "Investigation of Thermal Performance Characteristics of a Motorcycle Exhaust-Pipe System," Joint Conference of American Institute of Aeronautics and Astronautics and American Society of Mechanical Engineers, San Francisco, CA, AIAA2006-2924.

Bowman, A.J., Park, H., "Investigation and Development of Proposed General Pressure Drop and Heat Transfer Correlations for Laminar Flow in a Toroidal Coiled Tube System", IMECE2004-59872.

Bowman, A.J., Park, H., "CFD Study on Laminar Flow Pressure Drop and Heat Transfer Characteristics in a Spiral Coil System", ASME IMECE2004-59879.

Bowman, A.J., Park, H., "Development of Generalized Correlations for the Pressure Drop and Heat Transfer Applied in Helically Coiled Tube Systems", ASME IMCE 2003.

Bowman, A.J., Park, H., Hayes, B.Z., "Investigation and Development of Condensation Heat Transfer Correlations for Straight and Helically Coiled Tubes," ASME IMCE 2002-32900.

Park H., Bowman, A.J., "Prediction of Water Circulation Characteristics in a 4-Pass Firetube Boiler with the Non-Symmetric Arrangement of Tube Passes 3 and 4," ASME IMECE 2001 / AES-23603.

Company Reports (non-refereed)

Park H., Bowman, A.J., Cleaver-Brooks Boiler Efficiency Software and Users Manual, Cleaver-Brooks Company, Milwaukee, WI, October 1995.

Park H., Bowman, A.J., "C-B Vertical Boiler Analysis – Conceptual Design and Modeling (gas temperature and pressure drop in a pass using long-straight fin arrangement in passes 3 and 4)", Cleaver-Brooks Company, Milwaukee, WI, October 1995.

Park H., Bowman, A.J., MU Center for Energy Studies Technical Report Series: (i) "Induced Flue Gas Recirculation (IFGR) in C-B Firetube Boilers", (ii) "Prediction of Induced Flue Gas Recirculation Rate for High Pressure Steam Boiler Applications", (iii) "Evaluation of Field Performance of C-B Boilers", (iv) "Analysis Module Software Dev", (v) "Flow Rate Measurement of Induced Flue Gas Recirculation (IFGR)", Cleaver-Brooks Company, Milwaukee, WI, February 1993 – December 1994.

Software Proficiency

ANSYS, Apache Server, AutoCad, C++, CorelDraw, Engineering Equation Solver (EES), Fluent, FrontPage, Fortran, MatLab, Mathematica, Microsoft Office, MySQL, PHP, PSpice, SolidWorks, Unigraphics NX6, and MS Visual Basic .Net.

Professional Memberships (Current/Past)

American Society of Mechanical Engineers (ASME), American Society of Heating, Refrigeration and Air-Conditioning Engineers, Inc. (ASHRAE), American Institute of Aeronautics and Astronautics (AIAA), American Society of Engineering Educators (ASEE), American Indian Science and Engineering Society (AISES).

Honors and Awards

2000 Edward F. Obert Award – established in 1987 by the Advanced Energy Systems Division of the American Society of Mechanical Engineers to recognize outstanding research in thermodynamics.

1998 General Managers Award – Siemens Power Corporation for excellence in service, savings to the company in liquidated damages and profits to the company in performance bonuses.

1986 National Army Scholar Athlete Award

References

Dr. G.E. Otto Widera

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Dr. Raymond A. O. Fournelle

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Alfonso Fajardo, Wisconsin P.E.

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Al Fajardo was my supervisor during my employment with Siemens Power Corporation, now Siemens Energy Incorporated.

Dr. Richard A. Gaggioli

Emeritus Professor, Mechanical Engineering, Marquette University
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Dr. Gaggioli was my master's degree advisor and a committee member for my doctorate degree. I was a co-recipient of the 2000 Obert Award for excellence in thermodynamics research and am currently co-authoring an undergraduate textbook in thermodynamics with Dr. Gaggioli.

Dr. Hyunjae Park

Research Associate Professor, Mechanical Engineering, Marquette University
Director, Thermal-fluid Science and Energy Research Center
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Dr. Park was the primary advisor for my doctorate degree and a committee member for my master's degree. Dr. Park and I currently investigate industrial research projects with the TSERC and have co-authored an undergraduate graphics textbook.