

**2009 – 2010  
Graduate Program  
Self-study Report**

**Department of Mechanical Engineering  
California State University, Sacramento**

**June 1, 2010**

## **Self Study**

### **Master of Science Program**

### **Department of Mechanical Engineering**

**June 1, 2010**

The Department of Mechanical Engineering has chosen to conduct the Self Study of the M.S. program in accordance with Option C: Focused Inquiry, as described in the “Program Review Self Study Guidelines.”

Following the Option C format, our Self Study includes three main sections:

- i. General information about the program, e.g., data on students, faculty, staff, facilities, etc. (most of which is supplied by the Office of Institutional Research)**

### **Program History**

The Department of Mechanical Engineering at California State University, Sacramento was established in 1958. There has been consistently strong enrollment in the Department's B.S. and M.S. programs with a steady increase in the last decade. The M.S. program is designed to provide students with a strong theoretical background and an opportunity to apply their knowledge in a focused manner in the thesis/project component of the degree program.

### **Program Requirements**

#### **Required Core Courses (7 units)**

Engr. 201 Engineering Analysis I (3)

Engr. 202 Engineering Analysis II (3) or M.E. 206 Stochastic Modeling for Engineers (3)

M.E. 209 Research Methodology (1)

#### **Specialty Areas (9 units)**

Three courses must be selected from the following three areas of study.

Design and Dynamic Systems

Manufacturing

Thermal Energy Systems

#### **Electives (9-12 units)**

Select nine or twelve units of courses, in consultation with the student's faculty advisor. A maximum of two undergraduate courses may be used as elective courses. However no course can be used for both undergraduate and graduate credit. Student choosing the thesis option must take 9 units of electives, and students taking the project option must take 12 units of electives.

#### **Culminating Requirement (2 - 5 units)**

Two options:

Plan A: Master's Thesis (5 units)

Plan B: Master's Project (2 units)

### **Enrollment and Graduation Trends**

The enrollment and graduation trends for the last five years are summarized in Tables 1 through 5. The program has seen an increase in enrollment in the past few years. There were so many qualified applicants for Fall 2010 that only about one-third of the qualified applicants were admitted (16 were admitted). The MS degree in engineering is becoming more desired by industry across the country; our demand reflects this trend and local industry needs.

Most of our students are California residents although we are enrolling increasing numbers of international students. Most of the students are enrolled in 6 units per term and take about 3 years to finish the program. The Department of Mechanical Engineering has awarded 59 MS degrees in the past 5 years.

**TABLE 1: New Graduate Student Background**

<b>MS Students</b>	Fall 2005	Fall 2006	Fall 2007	Fall 2008	Fall 2009
<b>Institution of Origin</b>					
Sacramento State	1	1	7	1	6
Out of State	1	4	4	6	4
State College	1	1	1		2
University of California	1	2	5	1	1
Private				1	
<b>Total</b>	<b>4</b>	<b>8</b>	<b>17</b>	<b>9</b>	<b>13</b>
<b>Graduate Transfers</b>					
Master's Degree	1			1	

**Table 2: MS Degrees Awarded**

<b>Graduating Year</b>	<b>2004-05</b>	<b>2005-06</b>	<b>2006-07</b>	<b>2007-08</b>	<b>2008-09</b>
MS Degrees	20	16	9	5	9
<b>Average Years to MS Degree</b>					
ME Dept	3.3	2.8	3.3	2.9	2.3
ECS	2.9	3.0	3.0	2.8	2.3
University	3.0	3.3	3.0	2.8	2.3

**Table 3: Graduate Student Diversity**

	Fall 2005	Fall 2006	Fall 2007	Fall 2008	Fall 2009
<b>Total Enrolled</b>					
Department Total	30	26	38	50	58
College total	405	401	465	550	581
<b>Ethnicity</b>					
African American			1	4	4
American Indian					
Asian	8	6	8	8	11
Latino	3	2	4	4	7
All Minority	11	8	13	16	22
White/Caucasian	9	11	12	13	16
Foreign	5	4	8	15	17
Other/Unreported	5	3	5	6	3
Minority (College)	109	106	115	106	112
Minority (College)	1,438	1,434	1,457	1,448	1,417
<b>Gender</b>					
Female	1	2	2	2	2
Male	29	24	36	48	56
College-Female	87	93	104	104	112
College-Male	318	308	361	446	469
University-Female	3,350	3,393	3,456	3,284	3,164
University-Male	1,554	1,521	1,649	1,693	1,689

**Table 4: Graduate Student Profile**

	Fall 2005	Fall 2006	Fall 2007	Fall 2008	Fall 2009
<b>Enrollment Status</b>					
New	5	8	17	10	13
Continuing	25	18	21	38	44
Returning				2	1
<b>Residence</b>					
California Resident	24	22	30	35	42
Outside California	1		1	1	1
Foreign	5	4	7	14	15

**TABLE 5: Student Course Load**

	Fall 2005	Spring 2006	Fall 2006	Spring 2007	Fall 2007	Spring 2008	Fall 2008	Spring 2009	Fall 2009	Spring 2010
# Full-Time	10	6	9	9	17	15	27	25	21	12
# Part-Time	20	19	17	16	21	31	23	27	37	32
Dept. Mean Units	6.4	6.12	6.462	6.68	6.974	7.065	7.66	7.558	6.586	6.364
College Mean	7.047	7.203	7.648	7.767	7.787	7.673	7.833	7.387	6.869	6.211
University Mean	9.498	9.59	9.601	9.801	9.464	9.599	9.608	9.475	9.597	9.781

## **Program Constituencies**

Constituencies of CSU, Sacramento's M.S. in Mechanical Engineering are:

- Prospective students
- Students
- Graduates of the program
- Graduate schools
- Employers hiring our graduates
- Faculty
- Industry Advisory Council.

## **Faculty Competencies**

The Mechanical Engineering faculty have widely varied backgrounds, ranging from mechanical, aeronautical and industrial engineering, to engineering mechanics, manufacturing and materials science. Many have had significant industrial experience prior to joining our faculty. All have earned doctorates.

The following is a list of full-time faculty, by curriculum areas, with their highest degrees and areas of technical interest.

### **Applied Mechanics and Design**

Eke, Estelle, Ph.D., Aero/Astronautics, Rice University

Controls, optimization, modeling of dynamic systems

Granda, Jose J., Ph.D., Mechanical Engineering, University of California, Davis

System dynamics, finite-element analysis, Bond-graphs

Sprott, Kenneth, Ph.D., Mechanical Engineering, University of California, Davis Dynamics,

Mechanical Design, Automation, Robotics, Mechatronics

Suh, Yong, Ph.D., Mechanical Engineering, Rensselaer Polytechnic Institute

Computer-aided design, Rapid Proto-typing

Tuzcu, Ilhan, Ph.D., Mechanical Engineering, Virginia Tech

Aircraft design, controls

**Manufacturing**

Liu, Tien-I, Ph.D., Mechanical Engineering, University of Wisconsin, Madison Computer-integrated manufacturing, intelligent and precision manufacturing

Kumagai, Akihiko, Ph.D., Mechanical Engineering, Univ. of Wisconsin, Milwaukee  
Manufacturing, automation, mechanism design, mechatronics, kinematics, robotics

**Materials Science**

Bandy, Rabindranath, Ph.D., Metallurgical Science, University of Manitoba  
Corrosion, fracture mechanics, composite materials

Holl, Susan L., Ph.D., Material Science and Engineering, Univ. of California, Berkeley High-temperature chemistry, ceramics, semiconductors, silicon bonding

**Thermal Sciences**

Bergquam, James B., Ph.D., Mechanical Engineering, University of California, Berkeley Heat transfer, solar energy, HVAC

Marbach, Timothy, Ph.D., Oklahoma University  
Combustion, biomass conversion

Noren, Dan, Ph.D., University of California, Davis  
Fuel cells, engine design, modern power plant design

Zhou, Dongmei, Ph.D., University of Texas, Austin  
Computational fluid dynamics, fuel cells

- ii. **A statement of intended student learning outcomes at the program level; methods for assessing them, including the use of direct measures; assessment results to date; and documentation of the use of assessment results in efforts to achieve program improvement (assistance with the preparation of which is available from the University Assessment Coordinator).**

The objectives and student learning outcomes of the M.S. in Mechanical Engineering are as follows:

**Graduates of the M.S. Program in Mechanical Engineering:**

<b>Objective</b>	<b>Student Learning Outcome</b>
Will enter professional employment and/or Ph.D. programs in the following areas of mechanical engineering practice: machine design, thermal and fluids systems, and manufacturing	Will enter professional employment and/or Ph.D. program in a related field
Will use knowledge of the principles of science, mathematics, and engineering, to identify, formulate, and solve problems in mechanical engineering	Demonstrates knowledge of the principles of science, mathematics, and engineering, to identify, formulate, and solve problems in mechanical engineering
Will apply creativity in the design of systems, components, processes, and/or experiments and in the application of experimental results to independently address a focused research question	Demonstrate creativity in the design of systems, components, processes, and/or experiments and in the application of experimental results to independently address a focused research question
Will communicate effectively through speaking, writing, and graphics	Demonstrate effective written and oral communication using technical standards

These objectives and learning outcomes are consistent with the CSUS graduate learning goals which include pursuit of excellence, collaborative efforts, community and global engagement, ethics and social responsibility, and diversity and access.

The Department of Mechanical Engineering has developed a comprehensive assessment plan for the M.S. program modeled on our undergraduate assessment plan which has been endorsed by our accrediting body, ABET. Both the University Graduate Learning Goals and the M.S. in Mechanical Engineering objectives will be assessed.



The methods we will use to measure our progress toward these goals include developing a rubric for assessing the graduate learning goals; developing a rubric for assessing the educational objectives; developing a rubric for assessing writing; developing rubrics to assess each core course in the graduate curriculum; alumni surveys; and industry surveys. These assessment tools mirror the assessment tools developed for the undergraduate curriculum and used for our ABET evaluation.

In addition to the objectives and goals stated above, the Mechanical Engineering program is committed to assessing the ability of our students to meet the university graduate writing requirement.

### **Achievement of Program Outcomes**

The plan involves both direct and indirect assessment methods to evaluate the learning outcomes.

### **Methods**

The program outcomes are assessed using a variety of methods. The direct assessment methods include:

1. Faculty and Student assessment of success for each of the course outcomes which are associated with the program outcomes and objectives.
2. Evaluation of thesis/project reports using a standardized rubric. The reports will be evaluated for composition, technical content, and completeness.
3. Evaluation of the thesis/project presentations. The evaluation is based on content, presentation material, and completeness.
4. Evaluation of technical competence using targeted exam questions in key classes. Courses have been selected within each area of expertise to be used as indicators of technical competence within that area. Targeted exam questions will be used to quantify the level of understanding from each of the classes.

Indirect assessment methods include:

1. Student and alumni surveys.
2. Targeted surveys of students at different levels of the program.
3. Interviews with local employers.
4. Employer surveys.

Tables 6 and 7 provide a five year plan for MS program assessment including direct and indirect methods.

**Table 6. MS Program Assessment Plan**

	2009-10	2010-11	2011-12	2012-13	2013-14
Develop/ Review MS Program Outcomes	X			X	
Review of Performance Criteria evaluated for outcomes	X			X	
Review of mapping of course content to area and program outcomes	X			X	
Develop/Review assessment methods	X			X	
Evaluate Assessment Data and Processes		X	X	X	X
Take Action for improvement		X	X	X	X

**Table 7. Indirect Assessment Plan**

	2009-10	2010-11	2011-12	2012-13	2013-14
Student Survey	X	X	X	X	X
Alumni Survey	X			X	
Writing/Documentation Review	X	X	X	X	X
Thesis/Project Presentations	X	X	X	X	X
Targeted Surveys	X			X	
Employer Surveys		X		X	
Interviews with Employers	X	X	X	X	X
Evaluate Assessment Data and Processes		X	X	X	X
Take Action for improvement		X	X	X	X

**iii. The results of a focused inquiry addressing issues of particular interest/concern to the program itself, in the context of what is currently important to the college and university.**

The graduates of the M.S. program in Mechanical Engineering will either be employed in industry or government, or continue graduate school in a Ph.D. program. In all cases the graduates must be able to undertake and complete independent work and be able to effectively communicate the important aspects of their work.

Specifically we are interested in the following specific questions:

**1. How well does the curriculum and thesis/project component prepare students for industry employment or further graduate study?**

*To address this question we propose to*

- a. inventory the completed theses and projects over the last five years and evaluate these for effectiveness in providing an appropriate culminating experience, effective written and graphical communication, and consistency between various thesis advisors.*

There have been 59 theses/projects completed in the last five years. The quality of completed theses and project reports has continued to improve during the last few years. A major impetus for this increased quality has been the addition to our faculty of a number of new faculty who have served as advisors to the many MS students. Development of a published rubric for both faculty and students will ensure high quality and consistency in the theses submitted. In evaluating completed project reports and theses we have learned that most 'project reports' became similar to theses. The Department is now considering requiring every student to complete a thesis.

- b. survey graduates of the program to determine the effectiveness of the experience, and we will assess the importance of this component by surveying employers.*

We have not yet received many responses to our survey regarding the effectiveness of the thesis/project experience. We will continue to solicit responses and will evaluate data during the 2010-11 academic year.

Most of our MS students are working professionals. Many have projects influenced by their employment. We have not yet received many responses to our employer survey regarding the effectiveness of the thesis/project experience. We will continue to solicit responses and will evaluate data during the 2010-11 academic year.

- c. *survey current M.S. students to determine how well this component is integrated into the M.S. program.*

We have not yet received many responses to our survey regarding the how effectively the thesis/project component is integrated into the M.S. program. We will continue to solicit responses and will evaluate data during the 2010-11 academic year.

## **2. How well does the content and structure of the program meet the workforce needs of the region and California?**

*To address this question we will*

- a. *compare our M.S. curriculum and requirements to other programs in California, especially in the CSU system.*

MS programs in Mechanical Engineering and Engineering (Mechanical Option) in the CSU system were surveyed to determine degree requirements. All CSU programs have core requirements, elective requirements, and culminating experience requirements. Our program is structured similarly to others in the CSU requiring core engineering mathematics, courses toward a specific discipline, and elective courses. A few programs offer an exam option, but most require a thesis or project. Programs in the UC are more flexible, with no required core but requiring courses be approved by an advisor.

- b. *survey our graduates' employment status with particular focus on the assignments they have that require the M.S. degree.*

We have not yet received many responses to our employer survey regarding the effectiveness of the thesis/project experience. We will continue to solicit responses and will evaluate data during the 2010-11 academic year.

- c. *survey employers regarding their projected needs and their satisfaction with graduates of our program.*

We have not yet received many responses to our employer survey regarding the effectiveness of the thesis/project experience. We will continue to solicit responses and will evaluate data during the 2010-11 academic year. These results will be evaluated by the ME faculty and the ME Industry Advisory Council to determine areas of program improvement.

**3. How well does the content and structure of the program meet the needs of our faculty in maintaining fulfilling professional lives?**

*To address this question we will*

- a. *survey our faculty's scholarly productivity over the last five years. The data for 2004 to Spring 2009 were included in our ABET report and we will add the subsequent years' data.*

The Mechanical Engineering faculty have produced over 50 publications in journals and conferences over the last 5 years. Many of these involve students as co-authors. A partial listing of recent publications is provided in Appendix A (three of our faculty are on sabbatical until August 2010 and have not provided updated vitae for this self-study yet.) A list of recent theses and project reports archived in the CSUS Library is provided in Appendix B.

- b. *survey the faculty regarding their perception of workload, job satisfaction, and the direction of the program.*

<b>Faculty Survey</b>	
On a scale from 0 to 4 (4 being an A and 0 being an F) please rate the following:	
<b>Factor</b>	<b>Ranking</b>
1. your satisfaction with the course offerings for the M.S. Program	2.33
2. your satisfaction with the quality of the M.S. Students	3.67
3. your satisfaction with the final thesis quality produced	3.67
4. your satisfaction with the professional development opportunities provided by offering the ME MS program	2.5

The faculty seem satisfied with the student quality and the quality of the theses and project reports produced. They are not as satisfied with the course offerings and the opportunities for professional development. We will collect more information to determine if there are ways to increase faculty satisfaction in these areas. Additionally we will take this opportunity to compare results from other surveys, including employer surveys, to identify areas for improvement and to evaluate program direction.

- c. *survey students to assess their view of their research opportunities and faculty engagement in the program.*

<b>Student Survey</b>	
On a scale from 0 to 4 (4 being an A and 0 being an F) please rate the following:	
<b>Factor</b>	<b>Ranking</b>
1. your satisfaction with the research choices in the M.S. Program	
2. your satisfaction with choice of faculty advisors for M.S. Students	
3. your satisfaction with the research you conducted	
4. your satisfaction with your interaction with your research advisor	

We have not yet received many responses to our survey regarding the research opportunities. We will continue to solicit responses and will evaluate data during the 2010-11 academic year.

### **Concluding Remarks**

The Department of Mechanical Engineering welcomes the opportunity to systematically and comprehensively evaluate the curriculum and culminating experience component of our M.S. program. We believe that our strong MS program can be enhanced by this focused inquiry. We believe that our culminating experience is especially strong and, coupled with appropriate strong course offerings, our MS program will continue to provide quality education for our region.

# APPENDIX A

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**Publications and Thesis/Project Listing**

**(Partial)**



## **PUBLICATIONS**

**Eke, E.M.** (2009). *Computer Applications in Mechanical Engineering*. Proceedings of the 2009 American Society for Engineering Education Pacific Southwest Regional Conference. PSW#112, Vol.1.

**Granda J.J.** Teaching Virtual Product Design Using Dynamic Models at the Undergraduate and Graduate Levels . Virtual Product Development Conference. Phoenix, Arizona, April 2009

**J. J. Granda** and F. E. Cellier, eds. "Proceedings of ICBGM'2007. 8th International Conference on Bond Graph Modeling and Simulation" Simulation Series, Vol 39 Nr 1, SCS Publishing, ISBN: 1-56555-310-1 January 2007.

**Granda J. J.**, Nguyen L, Raval M, "Simplified Dynamic Model Generation and Vibration Analysis, of the International Space Station Mission 12A". AIAA InfoTech Aerospace Conference, May 2007, Rohnert Park, California

**Granda J. J.** "S-Domain Bond Graph Models Computer Generated Transfer Functions for Electrical Circuits and Operational Amplifiers " Proceedings of the 2007 International Conference on BondGraph Modeling and Simulation. San Diego. January 2007.

Nguyen L, Ramakrishnan J, **Granda J**, "International Space Station Centrifuge Rotor Models: A Comparison of the Euler-Lagrange and the Bond Graph Modeling Approach. Proceedings of the 2007 International Conference on Bond Graph Modeling and Simulation. San Diego. January 2007

**Granda J. J.**, Ramakrishnan J., Louis H. Nguyen "Centrifuge Rotor Models A Comparison of the Euler-Lagrange and the Bond Graph Modeling Approach". AIAA-Houston Annual Technical Symposium 2006 Gilruth Center May, 2006.

**Granda J.J.**, Nguyen Louis "Alternative Techniques for Developing Dynamic Analysis Computer Models of the International Space Station, Space Shuttle and Orbiter Repair Maneuvers". 47<sup>th</sup> AIAA/ASME/ASCE/AHS/ASC Structures, Structural Dynamics & Materials Conference. Newport, Rhode Island April 2006,

**J. J. Granda** and F. E. Cellier, eds. "Proceedings of ICBGM'2005. 7h International Conference on Bond Graph Modeling and Simulation" simulation Series, Vol 37 Nr 1, SCS Publishing, ISBN: 1-56555-287-3 January 2005.

**J. J. Granda** , I. Sandoval, L Horta, "Morphing Structural Concepts Evaluation Criteria Using Dimensionless Analysis and Computer Simulation . 46th AIAA/ASME/ASCE/AHS/ASC Structures, Structural Dynamics & Materials Conference. Austin, Texas, April , 2005

Elramady Alyaa, **Granda J.J.**, "Modal Analysis of the Zvesda Mission of the Space Station With Bond Graphs" Proceedings of the 2005 International Conference on Bond Graph Modeling and Simulation. New Orleans, January 2005.

**Granda J.J.**, “The CAMP-G Symbolic Solution to Algebraic Loops in Bond Graph Models”  
Proceedings of the 2005 International Conference on Bond Graph Modeling and Simulation.  
New Orleans, January 2005.

M. P. Breninford, C.A. Colinge, **S.L. Holl**, K. D. Hobart, and F. J. Kub, J. of The Electrochemical Soc., **156**,5,H303-H306 (2009)

Shin-Da Song, **Susan L. Holl**, Cynthia Colinge, Ki-Y Byun, K. D. Hobart, and Fritz Kub,  
Electrochemical Society Transactions, **16** (8) pp. 287 – 294 (2008)

**S. L. Holl**, C. Colinge,, K. D. Hobart, and F. J. Kub, J. of The Electrochemical Soc., **153**,7,G613-G616 (2006)

**S.L. Holl**, C.A. Colinge, S. Song, K. Hobart, F. Kub, Electrochemical Society Transactions Vol. **3-6**, pp. 67-73 (2006).

M.P. Breninford, D. Bailey, H. Ikram, C.A. Colinge, **S.L. Holl**, Electrochemical Society Transactions Vol. **3-6**, pp. 181-188 (2006).

H. Dang, **S. Holl**, C. Colinge, K. Hobart, Eighth International Symposium on Semiconductor Wafer Bonding Science, Technology, and Applications, Vol. **2005-02**, (2005)

**Liu, T.I., Kumagai, A.**, Wang, Y.C., Song, S.D., Fu, Z., and Lee, J., “On-Line Monitoring of Boring Tools Using Virtual Instrumentation and Intelligent Techniques,” *ASME Journal of Manufacturing Science and Engineering* (In Review).

**Liu, T.I., Kumagai, A.**, and Ordukhani, F., “Monitoring and Diagnosis of Roller Bearing Conditions Using Artificial Neural Networks,” *Journal of Mechanical Systems and Signal Processing* (In Review).

**Liu, T.I., Kumagai, A.**, and Lyons Carl, “On-Line Measurements for Monitoring and Diagnosis of Glass Production Furnaces,” *Journal of the Chinese Society of Mechanical Engineerins*, Vol. 27, No. 5, 2006, pp. 587-592.

Lewis, C., **Kumagai, A.**, Smith, W., Jolley, R., and Enan, W., “Development of a Prototype Tool With Collaboration by Physical Therapy, Biomedical Engineering and Mechanical Engineering,” 1st Annual Celebration of Research and Creative Activity, California State University, Sacramento, April 21, 2010

Lewis, C., **Kumagai, A.**, Smith, W., Jolley, R., and Enan, W., “Development of a Prototype Tool With Collaboration by Physical Therapy, Biomedical Engineering and Mechanical Engineering,” Community Based Research Conference, California State University, Sacramento, April 15, 2010.

**Kumagai, A., Liu, T-I**, Sul, D., “Radio Frequency Fuel Gauging with Neuro-Fuzzy Inference Engine for Future Spacecrafts,” Accepted for publication in the proceedings of the 10th International Association of Science and Technology for Development (IASTED)

Conference on Artificial Intelligence and Applications (AIA), Innsbruck, Austria, February 15-17, 2010, Paper No. 674-020.

**Kumagai, A., Suh, Y.,** Tracy, T., Naritomi, K., and Pierson, K., “Developing a Pen for Tremor Patients,” Proceedings of the 29th IASTED Conference on Modeling Identification and Control (MIC), Innsbruck, Austria, February 15-17, 2010, Paper No. 675-019.

**Kumagai, A., Liu, T.I.,** and Hozian, P., “Control of Shape Memory Alloy Actuators with a Neuro-Fuzzy Feedforward Element,” *Journal of Intelligent Manufacturing*, Vol. 17, No. 1, Feb. 2006, pp. 45-56.

**Kumagai, A., Liu, T.I.,** Khan, M., Yu, S., Johnson, R., Wargala, B., Little, A., and Bear, J., “Manufacturing Methods for Producing Water Pasteurization Indicators (WAPI),” *ASME International Mechanical Engineering Congress and Exhibition*, Chicago, IL, November 5-10, 2006, paper No. IMECE2006-15721.

Nishizawa, S., and **Kumagai, A.,** “Development of Programmable Force Line Generator for Coil Springs,” *Journal of Springs* (in Japanese), Vol. 50, 2005, pp. 39-46.

**Kumagai, A. Liu T.I.,** Setiadharmas S., and Komura Y., “Development of an Automated Liquid Handling System for Science Lab Automation” *Proceedings of the 2006 ASEE Annual Conference and Exposition*, Portland, OR, June 12-15, 2005, Session 2426.

Nishizawa, S., Ikeda, M., Logsdon, J., Sugiyama, T., Otani, I., Sato, N., **Kumagai, A.,** Harralson, H., Hozian, P. and Hamano, T., “Development of a Universal Spring Mechanism for Automobile Suspension System Design,” SAE World Congress, Detroit, MI, March 8-11, 2004, SAE Paper # 04AC-79.

**Liu, T.I.,** "Tools for Intelligent Manufacturing Processes and Systems: Neural Networks, Fuzzy Logic and Expert Systems," The CRC Handbook of Mechanical Engineering, pp. 13-91 to 13-95, 2004.

Cheung, Y\*. and **Marbach, T.L.,** “Utilization of Solar Energy to Supplement a Combined Cycle Power Plant,” Proceedings of the 41<sup>st</sup> Heat Transfer and Fluid Mechanics Institute, Sacramento, CA, June 2010 (to appear).

Sohi, C.\* and **Marbach, T.L.,** “Microalgae Biodiesel as a Substitute for Jet Fuel,” Proceedings of the 41<sup>st</sup> Heat Transfer and Fluid Mechanics Institute, June 2010 (to appear).

Kim, H.\* and **Marbach, T.L.,** “Experimental Study on Combustion of CH<sub>4</sub>-CO<sub>2</sub> and CH<sub>4</sub>-H<sub>2</sub> Mixture Fuels in Swirl Burner,” Proceedings of the 40<sup>th</sup> Heat Transfer and Fluid Mechanics Institute, Sacramento, CA, June 2008.

Proceedings of the 40<sup>th</sup> Heat Transfer and Fluid Mechanics Institute, edited by **Marbach, T.L.,** ISSN 0097-059X, 2008.

**Marbach, T.L.**, Sadasivuni, V. and Agrawal, A.K., "Investigation of a Miniature Combustor Using Porous Media Surface Stabilized Flame," Combustion Science and Technology, Vol. 179, No. 9, pp 1901-1922, 2007

Mrowka, A.L.\*, **Marbach, T.L.**, and Arnas, A.O., "Optimizing Wind Power for the Urban Environment," Proceedings of the 3<sup>rd</sup> International Energy, Exergy and The Environment Symposium, Evora, Portugal, July 2007.

Deal, B.\* and **Marbach, T.L.**, "Optimization of a Mesoscale Combustor Using Heat Recirculation and Porous Inert Media," Proceedings of ASME Energy Sustainability 2007, Long Beach, California, June 2007.

**Marbach, T.L.** and Agrawal, A.K., "Mesoscale, Porous Media Heat Recirculating Combustor," Proceedings of the 42<sup>nd</sup> AIAA, ASME, ASEE and SAE Joint Propulsion Conference, Sacramento, CA, July 2006.

**Marbach, T.L.** and Agrawal, A.K., "Computational Study of a Heat Recirculating Combustor Using Porous Inert Media," Proceedings of the 44<sup>th</sup> American Institute of Aeronautics and Astronautics Aerospace Sciences Meeting, Reno, Nevada, January 2006.

**Marbach, T.L.** and Agrawal, A.K., "Heat Recirculating Combustor Using Porous Inert Media for Mesoscale Applications," AIAA Journal of Power and Propulsion, Vol. 22, No. 1, pp. 145-150, 2006.

**Marbach, T.L.** and Agrawal, A.K., "Experimental Study of Surface and Interior Combustion Using Porous Inert Media," ASME Journal of Engineering for Gas Turbines and Power, Vol. 127, No. 2, pp. 307-313, 2005.

**Noren, D.A.**, "Thermoeconomic Simulation of Solid-Oxide-Fuel-Cell/Gas-Turbine Hybrid Systems for Distributed Tri-Generation," Ph.D. Thesis, University of California, Davis, 2007

**Noren, D.A.**, Hoffman, M.A., "Clarifying the Butler-Volmer Equation and Related Approximations for Calculating Activation Losses in Solid Oxide Fuel Cell Models," Journal of Power Sources 152 (2005) 175-181

**K. Sprott** and B. Ravani. Cylindrical Milling of Ruled Surfaces. To Appear in *International Journal of Advanced Manufacturing Technology*.

**Yong S. Suh** and Jeong-Je Yin, "Educational Software for Beam Loading Analysis Using Pen-Based User Interfaces", Computer Applications in Engineering Education, Accepted for publication, expected to be published in 2010 or 2011

**Yong S. Suh**, "Reconstructing Polyhedral CAD Models by Recognizing Extrusion Features from Single-View Drawings", ASME Journal of Computer Information Science in Engineering, Accepted, expected to be published in 2010

Kyungmo Kim, Jeong Je Yin, **Yong S. Suh**, "Application of Operating Window to Robust Process Optimization of Sheet Metal Forming", Journal of the Korean Society of Manufacturing Process Engineers, Vol.8, No.4, pp.110-121, December, 2009

Kyung Mo Kim, Jeong Je Yin, and **Yong S. Suh**, "Process Optimization of Sheet Metal Forming Using Operating Window," ASME 2009 International Design Engineering Technical Conference & Computers and Information in Engineering Conference IDETC/CIE, San Diego, CA, August 30 – September 2, 2009

**Yong S. Suh** and Jonathen McCasland\*, "Interactive Construction of Solids from Orthographic Multiviews for an Education Software Tool," Computer-Aided Design and Applications, Vol.6, No.2, pp.219-229, June 2009

**Yong S. Suh**, "Interactive Construction of Solids from Orthographic Multiviews for an Educational Software Tool," International CAD Conference and Exhibition, CAD '09, Reno, Nevada, June 8-12, 2009

**Y. S. Suh** and J. MacCasland\*, "Development of an Educational Software Tool for Interpretations of Multiview Engineering Drawings," Graphics Education in an Electronics Age, 63rd Annual Mid-Year Conference of the Engineering Design Graphics Division of ASEE, Berkeley, California, January 4-7, 2009

**Yong S. Suh**, "Reconstructing Polyhedral CAD models by recognizing extrusion features from single-view drawings ", ASME International Design Engineering Technical Conferences & Computers and Information in Engineering Conference, Las Vegas, Nevada, September 4-7, 2007

**Yong S. Suh**, "Reconstructing Polyhedral Swept Volume from a Single-View Sketch", *Proceedings of IEEE International Conference on Information Reuse and Integration*, Waikoloa Village, Hawaii, pp 585-588, September 16-18, 2006

Jong Cheon Park, **Yong S. Suh**, Byung H. Kim, "Decision of Conflicting Design Parameters Using a Multiattribute Utility Function Applied to Mold Design", *Proceedings of ASME IDETC 2005*, Long Beach, California, September 24-28, 2005

**Tuzcu, I.**, "On the Stability of Flexible Aircraft," *Aerospace Science and Technology*, 12 (2008) 376–384.

**Zhou, D.**, "Analysis of Self-Hydrating, Coupled Cathode PEM Fuel Cell Design Using Computational Fluid Dynamics Model," 40th HTFMI, June, 2008, Sacramento, CA

**Zhou, D.**, "A Computer Simulation of Fluctuating Pressure Fields in A Marine Propeller," 40th HTFMI, June, 2008, Sacramento, CA

**Zhou, D.**, “Turbulent Drag Reduction by Spanwise Wall Oscillation,” OMS-07-126, IJE, Vol.20, No.3, October 2007

**Zhou, D.**, “The Mechanism of Turbulent Drag Reduction by Spanwise Wall Oscillation,” AIAA/ASME/SAE/ASEE Joint Propulsion Conference, July, 2006, Sacramento, CA

**Zhou, D.**, “Effects of Spatial Resolution and Box Size on Numerical Solutions of Turbulent Flow,” ASME FEDSM2005-77231, June, 2005, Houston, TX

**Zhou, D.**, “Stabilization of the Combustion Process in Porous Burners,” 17<sup>th</sup> ONR Propulsion Meeting, June, 2004, Cambridge, MA

### **AWARDS**

**Bergquam, J.**, “Design and Installation of a Solar Air Conditioning System for the Salt River Project”, Phoenix, AZ, 2006, \$176,000.

### **PATENT**

Nishizawa, S. and **Kumagai, A.**, “Method and Apparatus for Modeling Coil Spring Using a Force Field Generator,” United States Patent 7606690, October 20, 2009.

### **THESIS/PROJECT (Partial Listing)**

Advisor: **James Bergquam**

Romani, Marcus, “Integrating a Night Sky Radiator into a Ground Source Heat Pump System”, Spring, 2005.

Arjomand-Kermani, Hamid Reza, “Design and Analysis of a Solar HVAC System in Palm Springs, CA, Summer 2006.

Advisor: **Akihiko Kumagai**

Kosuke Naritomi, “Design and Production of a Tremor Pen,” Fall 2009.

Dongun Sul, “Neuro-Fuzzy RF Fuel Gauging of Cryogenic Tank Under Low-Gravity Environment,” Summer 2009.

Tyrone Tracy, “ Vibration Reducing Pen for People with Tremors,” Summer 2009.

Weylon M. Malek, “Effects of Implementing a Predictive Maintenance Program into the Maintenance Division of the Environmental Utilities Department for The City of Roseville,” Spring 2009.

David Carrera, “Optimizing Glue and Heat Application for RTF Cabinet Doors,” Spring 2006.

Minhaj Khan, “Design of Experiments for Water Pasteurizing Indicator (WAPI) Manufacturing,” Fall 2005.

Kohi Le, “Finite Element Modeling of the Human Skin to Investigate Water Jet Cutting Parameters,” Spring 2005.

Yasuhisa Komura, “Analysis, Manufacturing, Testing of Automated Liquid Handling System for Bio-Medical Applications,” Spring 2004.

Mehdi Naqvi, “Improving the time response of a motion controller for SMA actuator using forced air cooling system,” Spring 2004.

Advisor: **Timothy Marbach**

Yuk Cheung, “Utilization of Solar Energy to Supplement a Combined Cycle Power Plant”, Spring 2010

Chandan Sohi, “Microalgae Biodiesel as a Substitute for Jet Fuel” Spring 2010

Manuel Leija, “Space Heating Design Options for Anheuser Busch’s Storage Facility Using Solar Wall and Evacuated Tube Collectors” Summer 2009

Josh Perron, “Mobile Vehicle Shower System” Summer 2009

Rupal Prajapati, “Computational Study of Methane and Air Combustion” 2008

Hosung Kim, “Biomass Combustor” 2008

Ben Deal, “Optimization of Porous Inert Media Mesoscale Combustor” 2007

Andrew Mrowka, “Wind Flow in the Urban Environment: Optimizing the Location of Wind Turbines on Buildings” 2006

# Appendix B

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Mechanical Engineering MS Theses and Projects



## Mechanical Engineering MS Theses and Projects

Fleshman, Joseph Tyler	Solar thermal heat rejection / Joseph Tyler Fleshman	Project (M.S., Mechanical Engineering) -- California State University, Sacramento, 2009	2009
Maazouddin, Amarddin Zerguy	Reducing drag for SUVs by wake control / Amarddin Zerguy Maazouddin	Thesis (M.S., Mechanical Engineering) - - California State University, Sacramento, 2009	2009
Storm, Matthew Mark	Active nocturnal cooling in a low humidity climate / Matthew Mark Storm	Project (M.S., Mechanical Engineering) -- California State University, Sacramento, 2009	2009
Gao, Zhiyu	On-line detection and measurements of drill wear using neuro-fuzzy systems / Zhiyu Gao	Thesis (M.S., Mechanical Engineering) - - California State University, Sacramento, 2008	2008
Hundal, Sukhbir	Building the space station to 2010 : a three dimensional dynamic model to predict modes of vibration, stress analysis and tracking of the sun ISS mission ULF5, shuttle mission STS 133 / Sukhbir Hundal	Thesis (M.S., Mechanical Engineering) - - California State University, Sacramento, 2008	2008
Kim, Hosung	Biomass combustor / Hosung Kim	Thesis (M.S., Mechanical Engineering) - - California State University, Sacramento, 2008	2008
Lindsey, Joseph Edward	Optimization of a liquid rocket engine's thermal protection system for weight savings / Joseph Edward Lindsey	Project (M.S., Mechanical Engineering) -- California State University, Sacramento, 2008	2008
Prajapati, Rupal G	Computational study of methane and air combustion / Rupal G. Prajapati	Project (M.S., Mechanical Engineering) -- California State University, Sacramento, 2008	2008
Sagar, Pawan	Comparison of 3D scan with the actual design / Pawan Sagar	Project (M.S., Mechanical Engineering) -- California State University, Sacramento, 2008	2008
Stachniuk, Waldemar	Advanced insulation concrete from design / Waldemar Stachniuk	Thesis (M. S., Mechanical Engineering) -- California State University, Sacramento, 2008	2008

## Mechanical Engineering MS Theses and Projects

Thao, Bee	The International Space Station: three dimensional computer model where technologies of multi-body dynamics, finite element modeling, and control system design meet ISS Mission 1J Shuttle Mission STS-126 / Bee Thao	Thesis (M.S., Mechanical Engineering) - - California State University, Sacramento, 2008	2008
Dabel, Jeremy William	A study of a self-hydrating PEM fuel cell design using a computational fluid dynamics model / Jeremy William Dabel	Thesis (M.S., Mechanical Engineering) - - California State University, Sacramento, 2007	2007
Deal, Benjamin Michael	Optimization of porous inert media mesoscale combustor	Thesis (M. S., Mechanical Engineering) -- California State University, Sacramento, 2007	2007
Gibbons, Luke J	Modeling considerations of nano-systems using bond graphs / Luke J. Gibbons	Thesis (M.S., Mechanical Engineering) - - California State University, Sacramento, 2007	2007
Jefferson, Albert	Hydrodynamic analysis of propeller-induced vibration / Albert Jefferson	Thesis (M.S., Mechanical Engineering) - - California State University, Sacramento, 2007	2007
Arjomand-Kermani, Hamid Reza	Design and analysis of a Solar HVAC System in Palm Springs, CA. / Hamid Reza Arjomand-Kermani	Project (M.S., Mechanical Engineering)- -California State University, Sacramento, 2006	2006
Bal, Harjot Singh	Redesigning the sprinkler valve using a float valve / Harjot Singh Bal	Project (M.S., Mechanical Engineering)- -California State University, Sacramento, 2006	2006
Carrera, David	Optimizing adhesive and heat application process for RTF cabinet doors / David Carrera	Project (M.S., Mechanical Engineering)- -California State University, Sacramento, 2006	2006
Joshi, Parth	Comprehensive analysis of building HVAC systems using TRACE-700 / Parth Joshi	Project (M.S., Mechanical Engineering)- -California State University, Sacramento, 2006	2006
Lee, Junyi	Applications of intelligent technique in manufacturing / Junyi Lee	Thesis (M.S., Mechanical Engineering)- -California State University, Sacramento, 2006	2006
Mrowka, Andrew L.	Wind flow in the urban environment optimizing the location of wind turbines on buildings / Andrew L. Mrowka	Project (M.S., Mechanical Engineering)- -California State University,	2006

## Mechanical Engineering MS Theses and Projects

		Sacramento, 2006	
Ngo, Bao A.	Evacuated-tube heat pipe solar collector simulation using Computational Fluid Dynamics (CFD) / Bao A. Ngo	Project (M.S., Mechanical Engineering)- -California State University, Sacramento, 2006	2006
Raval, Montu J.	Vibration analysis, orbiter repair maneuvers and alternative methods for computer modeling of the International Space Station Mission 12A / Montu J. Raval	Thesis (M.S., Mechanical Engineering)- -California State University, Sacramento, 2006	2006
Sabherwal, Manu	Computer aided design of vertical drilling machine tool utilizing solid modeling and finite element analysis concepts / Manu Sabherwal	Project (M.S., Mechanical Engineering)- -California State University, Sacramento, 2006	2006
Silva, Aaron Joseph	Design and analysis of an asphalt solar collector / Aaron Joseph Silva	Project (M.S., Mechanical Engineering)- -California State University, Sacramento, 2006	2006
Yang, John	Thermal analysis of a camera system / John Yang	Project (M.S., Mechanical Engineering)- -California State University, Sacramento, 2006	2006
Anderson, Kevin	Predicting performance of curved blade axi-symmetric swirlers / Kevin Anderson	Thesis (M.S., Mechanical Engineering)- -California State University, Sacramento, 2005	2005
Buske, Scott	Automated design and manufacture of a labeling machine / Scott Buske	Thesis (M.S., Mechanical Engineering)- -California State University, Sacramento, 2005	2005
Chana, Barjinder Singh	Auto drain system for an evaporative cooler / Barjinder Singh Chana	Project (M.S., Mechanical Engineering)- -California State University, Sacramento, 2005	2005
Chandra, Alfred	Analysis of a solar HVAC system for Los Angeles Valley Community College / Alfred Chandra	Project (M.S., Mechanical Engineering)- -California State University, Sacramento, 2005	2005
Farooqi, Rizwan H	Design of a gear assembly using solid works API programming / Rizwan H. Farooqi	Project (M.S., Mechanical Engineering)- -California State University, Sacramento, 2005	2005

## Mechanical Engineering MS Theses and Projects

Gill, Gurinder Singh	Monitoring and diagnosis tapping processes using neural network and soft computing / Gurinder Singh Gill	Project (M.S., Mechanical Engineering)- -California State University, Sacramento, 2005	2005
Hussain, Syed Raheel	Modeling of a steam jet ejector for a compression assisted absorption chiller cycle / Syed Raheel Hussain	Project (M.S., Mechanical Engineering)- -California State University, Sacramento, 2005	2005
Immeker, Shaun Gerrit	Heat transfer augmentation by ribs and grooves for electronics cooling / Shaun Gerrit Immeker	Thesis (M.S., Mechanical Engineering)- -California State University, Sacramento, 2005	2005
Kalyankar, Dilip M.	Dynamic modeling of the space station remote manipulator system to study its stress analysis, modes of vibration and maneuvers [sic] with the space shuttle / Dilip M. Kalyankar	Project (M.S., Mechanical Engineering)- -California State University, Sacramento, 2005	2005
Keen, Quentin A	Analysis of absorber plates in evacuated tube heat-pipe solar collectors / Quentin A. Keen	Project (M.S., Mechanical Engineering)- -California State University, Sacramento, 2005	2005
Khan, Minhaj	Design of experiments for Water Pasteurizing Indicator (WAPI) manufacturing / Minhaj Khan	Project (M.S., Mechanical Engineering)- -California State University, Sacramento, 2005	2005
Le, Khoi (Jay)	Finite element modeling of the human skin to investigate water jetcutting parameters / Khoi (Jay) Le	Thesis (M.S., Mechanical Engineering)- -California State University, Sacramento, 2005	2005
Parmar, Nainesh Mansukhbhai	Design and analysis of suspension system using Solidworks / Nainesh Mansukhbhai Parmar	Project (M.S., Mechanical Engineering)- -California State University, Sacramento, 2005	2005
Rickard, Jason William	Stochastic investigation of manufacturing failures through analysis of on-line measurement data / Jason William Rickard	Project (M. S., Mechanical Engineering)--California State University, Sacramento, 2005	2005
Romani, Marcus	Integrating a night sky radiator into a ground source heat pump system / Marcus Romani	Project (M.S., Mechanical Engineering)- -California State University, Sacramento, 2005	2005
Sandoval, Ignacio Quispe	Development of morphing airplane wing concept evaluation and selection matrix criteria / Ignacio Quispe Sandoval	Thesis (M.S., Mechanical Engineering)- -California State University, Sacramento, 2005	2005

## Mechanical Engineering MS Theses and Projects

Sharma, Ravi	HVAC with eQuest / Ravi Sharma	Project (M.S., Mechanical Engineering)- -California State University, Sacramento, 2005	2005
Siddiqui, Farhan Ahmed	Design, modeling & structural analysis of a solar powered lawn mower / Farhan Ahmed Siddiqui	Project (M.S., Mechanical Engineering)- -California State University, Sacramento, 2005	2005
Singh, Palvinder	Intelligent detection of ball bearing failures / Palvinder Singh	Project (M.S., Mechanical Engineering)- -California State University, Sacramento, 2005	2005
Toure, Sie	Design of a computer cooling system using Stirling engine technology / Sie Toure	Project (M.S., Mechanical Engineering)- -California State University, Sacramento, 2005	2005
Werlinich, Michael Stuart	Stormwater drain inlet insert / Michael Stuart Werlinich	Project (M.S., Mechanical Engineering)- -California State University, Sacramento, 2005	2005

