



Professor and Associate Dean for Research  
Allen E. Paulson College of Engineering & Computing

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# ANDRES L. CARRANO

## Research Interests

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Manufacturing Systems and Manufacturing Processes  
Sustainable Manufacturing  
Surface modeling, metrology and engineering.  
Novel applications of additive manufacturing  
3D Bioprinting.  
Environmental impacts of manufacturing and logistics operations.

## Academic Appointments

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[2017 – Present] Georgia Southern University Savannah-Statesboro, GA  
Associate Dean for Research and Faculty  
Allen E. Paulson College of Engineering and Computing  
& Professor (with tenure), Department of Manufacturing Engineering

[2013 – 2017] Auburn University Auburn, AL  
Philpott- WestPoint Stevens Endowed Associate Professor (with tenure)  
Department of Industrial and Systems Engineering *and*  
Department of Biosystems Engineering  
Samuel Ginn College of Engineering

[2006 - 2013] Rochester Institute of Technology Rochester, NY  
Associate Professor (with tenure)  
Department of Industrial and Systems Engineering  
Kate Gleason College of Engineering

[2009 – 2010] Kanazawa Institute of Technology Kanazawa, Japan  
Visiting Associate Professor

[2000 – 2006] Rochester Institute of Technology Rochester, NY  
Assistant Professor  
Department of Industrial and Systems Engineering  
Kate Gleason College of Engineering

## Education

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| North Carolina State University                | 2000 |
| • Ph.D. in Industrial and Systems Engineering. |      |
| North Carolina State University                | 1997 |
| • M.Sc. in Industrial and Systems Engineering. |      |
| Universidad Catolica Andres Bello (Venezuela)  | 1993 |
| • B.S. in Industrial Engineering.              |      |

## Awards and Honors

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- Fulbright Scholar. 2018.
- NASA Faculty Fellow. 2016.
- P3 Award. U.S. Environmental Protection Agency. 2016.
- Outstanding Faculty Teaching Award. ISE Department. Auburn University. 2014.
- Philpott-WestPoint Stevens Endowed Professorship. 2013-2017.
- IIE UPS Minority Advancement Award. Institute of Industrial Engineering. 2013.
- IIE Excellence in Teaching Lean Award. Institute of Industrial Engineering. 2010.
- IIE Curriculum Innovation Award. Institute of Industrial Engineering. 2009.
- Elsevier/ScienceDirect Certificate. Top 10 most downloaded articles. (3<sup>rd</sup> quarter 2006). International Journal of Thermal Sciences. (5-year impact factor = 3.707).
- P3 Award. U.S. Environmental Protection Agency. First Place. 2005.
- Rochester's Emerging Latino Leaders Award. 2006.
- New Faces in Engineering. National Engineering Week. 2003.
- Finalist. RIT Eisenhart Provost's campus-wide Award for Teaching Excellence. 2003.
- Inducted to the Phi Kappa Phi Honor Society. 1997.
- Outstanding Graduate Student Award. West Raleigh Rotary Club. 1999.
- Founding Chair. Society of Manufacturing Engineers (SME) student Chapter S-317. North Carolina State University. 1998-1999.
- Gran Mariscal de Ayacucho Excellence Fellowship. 1995-1996.
- Registered Professional Engineer (Venezuela). No. 94944. Awarded 12/12/1994.

## Other Appointments

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- Visiting Researcher. Universita del Salento. Lecce, Italy. Summer 2018.
- Visiting Researcher. Marshall Space Flight Center. NASA. In-space 3D-print manufacturing ZP-30 project. 2016.
- President. MHI College-Industry Council in Material Handling Education 2014-2015.
- Founding Director. Toyota Production Systems Laboratory 2006-2013.
- Director. Brinkman Advanced Manufacturing and Machine Tools Lab. 2002-2006.
- Board of Directors. Lean Division. Institute of Industrial Engineering. 2012-2013.
- Visiting Associate Professor. Yeditepe University. Istanbul, Turkey. Summer 2009 and summer 2011.
- Core Faculty. Master of Science in Manufacturing Leadership. Rochester Institute of Technology. 2000-2013.
- Affiliated faculty. Laboratory for Environmental Computing and Decision Making. Rochester Institute of Technology. 2008-2012.

- Research Assistant. Wood Machining and Tooling Research Program. Department of Forest Biomaterials. North Carolina State University. 1998-2000.
- Research Assistant. Furniture Manufacturing and Management Center. North Carolina State University. 1996-1998.
- Research Assistant. Precision Engineering Center. North Carolina State University. 1995-1996.
- Instructor. School of Industrial Engineering. Universidad Catolica Andres Bello. Caracas, Venezuela. 1993-1995.
- Engineering Intern. Paraguana Oil Refinery Complex (world's second largest). Petroleos de Venezuela (PDVSA). Paraguana Peninsula. Venezuela. Summer 1992.
- Engineering Intern. El Tablazo Petrochemical Complex. Petroquimica de Venezuela (Pequiven S.A). Maracaibo, Venezuela. Summer 1991.

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Publications [Under review or near submission]

\* student contribution

- Manjinder\*, K., Blersch, D.M., **Carrano, A.L.** Substratum topography affects algal turf productivity and species selection under different nutrient conditions. (under review in *Environmental Technology*).
- Khoshkhoo\*, A., **Carrano, A.L.** Blersch, D.M., Kardel, K. Engineering of bio-mimetic substratum topographies for enhanced early colonization of filamentous algae. (under review, *PLoS One*)

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Publications [Journal Articles]

\* student contribution

- Gong, H., Snelling, D., Kardel, K., **Carrano, A.L.** (2019) Comparison of Stainless Steel 316L Parts Made by FDM- and SLM-Based Additive Manufacturing Processes. *JOM. The Journal of the Minerals, Metals and Materials Society*. <https://doi.org/10.1007/s11837-018-3207-3>. Impact factor: 2.145.
- Khoshkhoo\*, A., **Carrano, A.L.** Blersch, D.M. (2018). Effect of build orientation and part thickness on dimensional distortion in material jetting processes. *Rapid Prototyping Journal*. doi: 10.1108/RPJ-10-2017-0210. Impact factor: 3.179
- Kardel\*, K., Blersch, D.M., **Carrano, A.L.** (2018). Custom design of substratum topography increases biomass yield in algal turf scrubbers. *Environmental Engineering Science*. Vol. 35, No 8. doi: 10.1089/ees.2017.0354. Impact Factor: 1.426.
- Khoshkhoo\*, A., **Carrano, A.L.**, Blersch, D.M. (2018) Effect of surface slope and build orientation on surface finish and dimensional accuracy in material jetting processes. *Procedia Manufacturing*. pp. 720-730. doi: 10.1016/j.promfg.2018.07.082
- Tornese\*, F., Pazour, J.A., Thorn, B.K., Roy, D., **Carrano, A.L.** (2018). Investigating the environmental and economic impact of loading conditions and repositioning strategies for pallet pooling providers. *Journal of Cleaner Production*. 172(2018): 155-168. doi: 10.1016/j.jclepro.2017.10.054. Impact Factor: 6.207
- Elliot\*, O, Gray\*, S., McClay\*, M., Nassief\*, B., Nunnelley\*, A., Vogt\*, E. Ekong\*, J., Kardel\*, K., Khoshkhoo\* A., Proano\*, G., Blersch, D.M., **Carrano, A.L.** (2017). Design and manufacturing of high surface area 3D-printed media for moving bed bioreactors for wastewater treatment. *Journal of Contemporary Water Research and Education*. Issue 160. Pages 144-156.
- Kardel\*, K., Ghaednia\*, H., **Carrano, A.L.**, and Marghitsu, D.B (2017). Experimental and theoretical modeling of behavior of 3D-printed polymers under collision with a rigid rod. *Additive Manufacturing*. 14(2017):87-94. doi: 10.1016/j.addma.2017.01.004.
- Blersch, D.M., Kardel\*, K., **Carrano, A.L.**, and Kaur, M. (2017) Customized 3D-printed surface topography governs species attachment preferences in a fresh

water periphyton community. *Algal Research*. 21(2017):52-57. doi: 10.1016/j.algal.2016.10.027. Impact Factor=4.621.

- Tornese\*, F., **Carrano, A.L.**, Thorn, B.K., Pazour, J.A., Roy, D. (2016) Carbon footprint analysis of pallet remanufacturing. *Journal of Cleaner Production*. 126(2016):630-642. doi: 10.1016/j.jclepro.2016.03.009. Impact Factor=6.207.
  - Roy, D., **Carrano, A.L.**, Pazour, J.A., Gupta\*, A. (2016). Cost-effective pallet management strategies. *Transportation Research Part E: Logistics and Transportation Review*. 93(2016):358-371. doi: 10.1016/j.tre.2016.06.005. Impact Factor= 3.319.
  - Marshall, M.M., **Carrano, A.L.** and Dannels, W. (2016). Adapting experiential learning to develop problem solving skills in deaf and hard of hearing engineering students. *Journal of Deaf Studies and Deaf Education*. 21(4):403-415. doi:10.1093/deafed/enw050. Impact Factor=1.917.
  - Kardel\*, K. **Carrano, A.L.** Blersch, D.M and Kaur\*, K. (2015) Preliminary development of 3D printed custom substrata for benthic algal biofilms. *3D Printing and Additive Manufacturing*. 2(1):12-19. doi:10.1089/3dp.2014.0024. Impact Factor= 3.389.
  - **Carrano, A.L.**, Pazour, J.A., Roy, D., Thorn, B.K. (2015). Selection of pallet management strategies based on carbon-equivalent emissions impact. *International Journal of Production Economics*. Volume 164: 258-270. doi:10.1016/j.ijpe.2014.09.037. Impact Factor=3.548.
  - **Carrano, A.L.**, Thorn, B.K., Woltag\*, H. (2014) Characterizing the carbon footprint of wood pallet logistics. *Forest Products Journal*. 64(7/8):232-241. doi:10.13073/FPJ-D-14-00011.
  - Kataria\*, H., **Carrano, A.L.**, Thorn, B.K. (2012). Modeling of tooling-workpiece interactions on random surfaces. *Advances in Mechanical Engineering*. Volume 4. 2012: 807018. doi: 10.1155/2012/807018.
  - Mazeika-Bilbao\*, A., **Carrano, A.L.**, Hewitt, M., and Thorn, B.K. (2011). On the environmental impact of pallet management operations. *Management Research Review*. Volume 34. Issue 11. pp: 1222-1236.
  - Briceno\*, C.M., **Carrano, A.L.**, Thorn, B.K., Esterman, M. (2009). A design optimization framework to estimate environmental impacts of design decisions in consumer products. *Journal of Green Building*. Volume 4. No. 2, pp: 141-149.
  - **Carrano, A.L.**, Kuhl, M.E., and Marshall, M.M. (2008). Integration of an assembly systems engineering laboratory module. *International Journal of Engineering Education*. Vol 24. No.5. pp: 1012-1017.
  - **Carrano, A.L.** and Thorn, B.K. (2007). A multidisciplinary approach to sustainable product and process design. *IEEE Engineering Management Review*. Reprint for special issue in Sustainable Design. Vol 35. Issue No. 3. pp: 57. doi: 10.1109/EMR.2007.4296427. Impact Factor=3.380.
  - **Carrano, A.L.**, Thorn, B.K., and Lopez\*, G. (2007). An integer programming approach to the construction of trend-free experimental plans on split-plot designs. *Journal of Manufacturing Systems*. Vol 25. No 1. pp: 39-44. doi:10.1016/S0278-6125(06)80031-2. Impact Factor=3.699.
  - **Carrano, A.L.**, Vora\*, B.S, Sahin, F.E, and Lemaster. R.L. (2007). Monitoring of abrasive loading for optimal belt cleaning or replacement. *Forest Products Journal*. 57(5):78-83.
  - Taylor, J.B., **Carrano, A.L.**, and Kandlikar, S.G. (2006). Characterization of the effect of surface roughness and surface texture on fluid flow: past, present and future. *International Journal of Thermal Sciences*. Vol 45. Issue 10. pp: 962-968. Impact Factor=4.041.
- This paper was awarded a certificate from Elsevier/ScienceDirect as a top 10 most downloaded article from this journal in 2006.*
- Thorn, B.K., **Carrano, A.L.**, Plaz\* C.R., Wood\*, C.R., and Guedez, E. (2006). User-driven design of low-cost, low environmental impact solar ovens for rural populations in developing countries. *Journal of Engineering for Sustainable Development*. Vol. 1(1). Pages: 1-12. doi: 10.3992/2166-2517-1.1.1

- Kandlikar, S.G., Schmitt\*, D., **Carrano A.L.** and Taylor, J.B. (2005). Characterization of surface roughness effects on pressure drop in single-phase flow in mini channels. *Physics of Fluids*. 17:1. American Institute of Physics. Impact Factor=2.415.
- **Carrano, A.L.**, and Taylor, J.B. (2005). Geometric modeling of engineered abrasive processes. *Journal of Manufacturing Processes*. Vol 7. Issue No. 1. Impact Factor=2.809.
- **Carrano, A.L.** and Thorn, B.K. (2005). A multidisciplinary approach to sustainable product and process design. *Journal of Manufacturing Systems*. Vol 24. No. 3. pp: 209-214. Impact Factor=3.699.
- **Carrano, A.L.**, Taylor, J.B., Young, R, Lemaster, R. and Saloni\*, D. (2004). A comparison of fuzzy modeling and statistical regression on abrasive wood machining. *Forest Products Journal*. 54(5):66-72.
- **Carrano, A.L.**, Taylor, J.B., and Lemaster, R.L. (2004). Machining induced subsurface damage of wood. *Forest Products Journal*. 54(1):85-91.
- **Carrano, A.L.**, Taylor, J.B., and Lemaster, R.L. (2002). Parametric characterization of peripheral sanding. *Forest Products Journal*. 52(9):44-50.
- Taylor, J.B., **Carrano, A.L.**, and Fathi, Y. (2000). Parametric Design and Optimization for a Non-Linear Precision X-Y Microstage. *Journal of Manufacturing Systems*. Vol(19): 229-238. No. 4. Impact Factor=3.699.
- Taylor, J.B., **Carrano, A.L.**, and Lemaster, R.L. (1999). Quantification of Process Parameters in a Wood Sanding Process. *Forest Products Journal*. 49(5):41-46.
- **Carrano, A.L.** and Taylor, J.B. (1999). Cooperative learning factories and their impact on learning styles. (Spanish). *Tekhné Journal*. Vol(3):17-25. Universidad Catolica Press. Venezuela.

#### Publications [Book Chapters]

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- Gnoni, M.G., Tornese, F., Thorn, B.K., Pazour, J.A, **Carrano, A.L.** A Measurement Tool for Circular Economy Practices: a Case Study in Pallet Supply Chains. Progress in Material Handling Research. Volume XV. (2018). Ballot, E., Carrano, A.L., Ellis, K.P., Ferrell, W., Porter, J.D., Reed, D. (Eds).
- Tornese, F., Pazour, J.A, **Carrano, A.L.**, Thorn, B.K. Improving the Environmental Sustainability of Pallet Logistics through Preemptive Remanufacturing: an Integer Linear Optimization Model. Progress in Material Handling Research. Volume XV. (2018). Ballot, E., Carrano, A.L., Ellis, K.P., Ferrell, W., Porter, J.D., Reed, D. (Eds).
- Chapter 10: Metrology and Inspection. De Garmo's Materials and Processes in Manufacturing. 12th Edition. (2017). Pages 192-217. JT Black, and Ronald A. Kosher editors. Wiley. 864 pages. ISBN: 978-1-118-98767-4.
- **Carrano, A.L.**, Erin, R.\*, and Sudit, M. (2013). An MIP approach to the U-line balancing problem with proportional worker throughput. Book Chapter. Progress in Material Handling Research. Volume XII. Montreuil, B., Carrano, A.L., Gue, K., de Koster, R., Ogle, M., Smith, J (Eds). pp: 112-130. ISBN: 978-1-882780-17-5.

#### Publications [Proceedings]

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- Kardel, K., Khoshkhoo\*, A., **Carrano, A.L.** Understanding distortion in material jetting processes. 29th Annual International Solid Freeform Fabrication Symposium. August 13-15, 2018. Austin, Texas. USA.
- Gong, H., Snelling, D., Kardel, K., **Carrano, A.L.** Comparison of stainless steel 416L parts made by FDM-based and SLM-based additive manufacturing processes. 29th Annual International Solid Freeform Fabrication Symposium. August 13-15, 2018. Austin, Texas. USA.
- Khoshkhoo\*, A., **Carrano, A.L.**, Blerch, D.M. Effect of surface slope and build orientation on surface finish and dimensional accuracy in material jetting

processes. 46th SME North American Manufacturing Research Conference. NAMRC 46. June 18-22, 2018. College Station, Texas, USA.

- Khoshkhoo\*, A., **Carrano, A.L.**, Blersch, D.M., Ghaednia\*, H., and Kardel\*, K. Understanding and engineering of natural surfaces with additive manufacturing. 28th Annual International Solid Freeform Fabrication Symposium. August 7-9, 2017. Austin, Texas. USA.
- **Carrano, A.L.**, Kardel\*, K., and Blersch, D.M. Understanding attachment preferences of benthic algae through controlled surface topography on 3D-printed substrata. 5th International Conference on Surface Metrology. April 4-7, 2016. Poznan, Poland.
- Thorn, B.K., **Carrano, A.L.** Development of a sustainable engineering master's program: the path taken and lessons learned. 7th International Conference on Engineering Education for Sustainable Development (EESD 2015). Vancouver, Canada. June 9-12, 2015.
- Sriram\*, S., **Carrano, A.L.**, Kuhl, M.E., Thorn, B.K. A novel protocol for U-shaped assembly lines. Proceedings of the 2014 Winter Simulation Conference. A. Tolk, S.D. Diallo, I.O. Ryzhov, L. Yilmaz, S. Buckley, and J.A. Miller, eds. December 7-10, 2014. Savannah, Georgia.
- **Carrano, A.L.**, Dannels, W. and Marshall, M.M. Integration of experiential Learning to develop problem solving skills in deaf and hard of hearing students. 121st ASEE Annual Conference and Exposition. American Society of Engineering Education. Indianapolis, Indiana. June 15-18, 2014.
- DeVierno\*, A., Thorn, B.K., **Carrano, A.L.** Combining Life Cycle Assessment and Linear Regression analysis to determine significant design characteristics. ASME International Design Engineering Conference IDETC/CIE 2012. Chicago, Illinois. August 12-15, 2012.
- Esterman Jr., M.E., Gujja\*, R., Proano, R., Krishna\*, K., **Carrano, A.L.** Design for assembly line performance: the link between DFA and line performance metrics. 2012 International Forum on Design for Manufacture and Assembly. Boothroyd and Dewhurst DFMA. Providence, Rhode Island. June 12-13, 2012.
- Thorn, B.K., Brownell, S. and **Carrano, A.L.** Development and Delivery of "Engineering for the Developing World", a course supporting the masters programs in Sustainable engineering at RIT". 4th International Conference of Education Research and Innovation. ICERI 2011. November 14-16, 2011. Madrid, Spain.
- Sridharan\*, A., **Carrano, A.L.**, Bonzo, J.L. High pressure coolant effect on PVD coated inserts during end milling of Ti-6Al-4V. Industrial Engineering Research Conference, IERC 2011. May 21-25, 2011. Reno, Nevada.
- **Carrano, A.L.**, Kaemmerlen, J.K., Mozrall, J.R. Systematic development of an experiential-based learning environment in engineering. 3rd International Conference of Education Research and Innovation. ICERI 2010. November 15-17, 2010. Madrid, Spain.
- Thorn, B.K., **Carrano, A.L.**, Brownell, S. Development and implementation of a sustainable engineering curriculum. 3rd International Conference of Education Research and Innovation. ICERI 2010. November 15-17, 2010. Madrid, Spain.
- Mazeika\*, A., **Carrano, A.L.**, Thorn, B.K. Environmental impact analysis of pallet management. Industrial Engineering Research Conference, IERC 2010. June 5-9, 2010. Cancun, Mexico.
- Thorn, B.K., **Carrano, A.L.** Integration of sustainable engineering into the industrial engineering curriculum. Industrial Engineering Research Conference, IERC 2010. June 5-9, 2010. Cancun, Mexico.
- **Carrano, A.L.**, Kaemmerlen, J., Mozrall, J.R. Toyota Production Systems Lab: A unique environment to support experiential-based learning. Industrial Engineering Research Conference, IERC 2010. June 5-9, 2010. Cancun, Mexico.
- Thorn, B.K., **Carrano, A.L.** Development of Master's Programs in Sustainable Engineering at the Rochester Institute of Technology. 2008 ASEE Annual

Conference and exposition. American Society of Engineering Education. June 22-25, 2008. Pittsburgh, Pennsylvania

- Briceno\*, C.M., **Carrano, A.L.**, Thorn, B.K., Esterman, M. An environmental-impact optimization framework for assessing trade-offs in consumer product development. Industrial Engineering Research Conference, IERC 2008. May 17-21, 2008. Vancouver, Canada
- Thorn, B.K., Wood\*, C.R., **Carrano, A.L.** Economic and environmental impacts of collecting waste cooking oil for biodiesel production. Industrial Engineering Research Conference, IERC 2008. May 17-21, 2008. Vancouver, Canada
- Thorn, B.K. and **Carrano, A.L.** Integrating sustainable product development into the engineering curriculum. American Society of Engineering Education. ASEE St. Lawrence Section Annual Conference. November 17-18, 2006. Cornell University. Ithaca, New York
- Thorn, B.K., **Carrano, A.L.**, Wood, C.R., and Plaz\*, C.R. Design, development and deployment of low impact solar ovens for impoverished populations. Industrial Engineering Research Conference, IERC 2006. May 20-24, 2006. Orlando, Florida
- Taylor, J.B., **Carrano, A.L.**, and Kandlikar, S.G. Characterization of the effect of surface roughness and texture on fluid flow: Past, present and future. (Keynote). Proceedings of ASME-ICNMM 2005. 3rd International Conference on Microchannels and Minichannels. ASME. June 13-15, 2005. Toronto, Canada.
- **Carrano, A.L.** and Thorn, B.K. A multidisciplinary approach to sustainable product and process design. CIRP International Conference in Manufacturing Engineering Education. pp 43-49. June 22-25, 2005. San Luis Obispo, California.
- Stiebitz, P.H., **Carrano, A.L.**, Taylor, J.B., Plaz\*, C.R., and Mestry\*, S. Swarm of microsystem particles for multi-axial morphogenic rapid prototyping. Industrial Engineering Research Conference, IERC 2005. May 14-18, 2005. Atlanta, Georgia
- Kandlikar, S. G, Schmitt\*, D., **Carrano, A.L.** and Taylor, J.B. Characterization of surface roughness effects on pressure drop in single-phase flow in mini/micro channels. (Keynote). Transport Phenomena in Micro and NanoDevices. Engineering Conference International (ECI). October 17-21, 2004. Kona Coast, Island of Hawaii.
- **Carrano, A.L.** and Thorn, B.K. The construction of trend-free experimental plans on two-level split-plot designs. Industrial Engineering Research Conference, IERC 2004. May 15-19, 2004. Houston, Texas
- **Carrano, A.L.**, Mehta\*, B and Low, J.C. Response surface methodology in RAM EDM processes. Industrial Engineering Research Conference, IERC 2004. May 15-19, 2004. Houston, Texas
- Kuhl, M.E, and **Carrano A.L.** Collaborative development and integration of laboratory material utilizing a flexible manufacturing cell. American Society of Engineering Education ASEE St. Lawrence Annual meeting and conference. October 24-25, 2003. Queen's University. Kingston, Ontario, Canada
- **Carrano, A.L.**, Kuhl, M.E., and Marshall, M.M. Design and implementation of an experiential assembly systems engineering laboratory module. ASEE Annual Conference and Exposition. June 22-25, 2003. Nashville, Tennessee.
- **Carrano, A.L.** Effect of abrasive tooling geometry on roughness descriptors. Industrial Engineering Research Conference, IERC2003. May 18-21, 2003. Portland, Oregon.
- Vainrub, R., **Carrano, A.L.**, and Taylor, J.B. Strategic global alliances in engineering education. Ninth International Conference on Industry, Engineering and Management Systems, IEMS 2003. March 17-19, 2003. Cocoa Beach, Florida.
- Saloni\*, D.F., Lemaster, R.L., and **Carrano, A.L.** Comparison between geometric shapes of engineered abrasives on material removal and surface quality.- Part II. Industrial Engineering Research Conference, IERC2003. May 18-21, 2003. Portland, Oregon.

- Saloni\*, D.F., Lemaster, R.L., and **Carrano, A.L.** Traditional versus engineered abrasive on material removal and surface quality. Industrial Engineering Research Conference, IERC2002. May 19-22, 2002. Orlando, Florida.
- **Carrano, A.L.**, Taylor, J.B., and Lemaster, R.L. Geometric modeling of engineered abrasive processes. Industrial Engineering Research Conference, IERC2001. May 20-22, 2001. Dallas, Texas.
- Taylor, J.B., Lemaster, R.L., and **Carrano, A.L.** Surface generation modeling, assessment and optimization in wood machining. Forest Product Society Annual Meeting. June 18-21, 2000. Lake Tahoe, Nevada.
- **Carrano, A.L.** and Taylor, J.B. Process modeling of abrasive machining in wood industry. Industrial Engineering Research Conference, IERC2000. May 21-23, 2000. Cleveland, Ohio.
- Taylor, J.B., Lemaster, R.L., and **Carrano, A.L.** Experimental modeling of the sanding process - The relationship between input and output parameters. 14th International Wood Machining Seminar. IWMS 14. September 13-18, 1999. Paris, France.
- Taylor, J.B., **Carrano, A.L.** and Lemaster, R.L. Assessment of surface quality of machining processes in the wood-based furniture industry. Industrial Engineering Research Conference, IERC99. May 23-24, 1999. Phoenix, Arizona
- Taylor, J.B., **Carrano, A.L.** and Decrescenzo\*, E.J. Parameter Design and Optimization of a Kinematic Coupling Mechanism. Industrial Engineering Research Conference IERC98. May 9-10, 1998. Banff, Alberta. Canada.

#### Publications [Technical Reports]

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- Selected on-demand medical applications of 3D-printing for long-duration manned space missions. In N.F. Six and G. Karr (Eds), Marshall Space Flight Center Faculty Fellowship Program. NASA/TM-2017-218234. pp: 52-61. National Aeronautics and Space Administration.
- The state of the material handling education: an environmental scan. (2013). Report to the College Industry Council in Material Handling Education. MHI. doi: 10.13140/RG.2.2.12672.43524.
- Experimental modeling of sanding processes. (1999). Technical Report TR99-02. Furniture Manufacturing and Management Center. North Carolina State University.
- Robotic sanding of wood-based furniture components with complex contours - II. (1998). Technical Report TR98-03. Furniture Manufacturing and Management Center. North Carolina State University.
- Robotic sanding of wood-based furniture components with complex contours I. (1997). Technical Report 97-04. Furniture Manufacturing and Management Center. North Carolina State University.
- Robust parametric design of a precision X-Y microstage with a maneuverable kinematic coupling mechanism - III. (1997). Interim Report. pp. 17-19. Precision Engineering Center. North Carolina State University.
- Robust parametric design of a precision X-Y microstage with a maneuverable kinematic coupling mechanism - II. (1996) Annual Report. pp. 55-62. Precision Engineering Center. North Carolina State University.
- Robust parametric design of a precision X-Y microstage with a maneuverable kinematic coupling mechanism - I. (1996) Interim Report. pp. 31-34. Precision Engineering Center. North Carolina State University.



## Publications [Monographs]

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- **Carrano, A.L.** [2000]. Characterization of wood surface preparation. Ph.D. Dissertation. Edward P. Fitts Department of Industrial and Systems Engineering. North Carolina State University. Raleigh, NC.
- **Carrano, A.L.** [1997]. Quantification of the effect of process parameters on a wood sanding process. Master of Science Thesis. Edward P. Fitts Department of Industrial and Systems Engineering. North Carolina State University. Raleigh NC.

## Exhibitions

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- TechConnect World Innovation Conference and Expo and National SBIR/STTR Conference. May 14-17, 2017. Washington DC. Exhibit on 3D printed biofilters for ammonia removal from fisheries wastewaters (co-advised a team of 3 graduate students).
- USA Science and Engineering Expo. U.S. Washington D.C. Exhibit on 3D printed ultra-high surface area moving bed biofilters (†). April 2016. (co-advised a team of 3 biosystems engineering and 4 industrial engineering undergraduate students).

*(†)This exhibit was awarded the first place award by the EPA among 60 universities nationwide.*

- 3<sup>rd</sup> National Sustainable Design Expo. The National Academies and the U.S. EPA, Washington D.C. Exhibit on self-contained human powered LED systems for use in the developing world. May, 2007. (co-advised a team of 7 undergraduate multi-disciplinary engineering students).
- 2<sup>nd</sup> National Sustainable Design Expo. The National Academies and the U.S. EPA, Washington D.C. Exhibit on heat exchangers for water pasteurization to treat water in rural areas. April, 2006. (co-advised a team of 5 undergraduate multi-disciplinary engineering students).
- 2<sup>nd</sup> National Sustainable Design Expo. The National Academies and the U.S. EPA, Washington D.C. Exhibit on energy efficient designs of solar ovens for developing countries. May, 2006. (co-advised a team of 6 undergraduate multi-disciplinary engineering students).
- 1<sup>st</sup> National Sustainable Design Expo. The National Academies and the U.S. EPA, Washington D.C. Exhibit on low cost solar oven design (\*). April, 2005. (co-advised a team of 7 undergraduate multi-disciplinary engineering students).

*(\*)This exhibit was awarded the first place award by the National Academies among 60 universities nationwide.*

## Publications [Case Study]

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- "Fresh Food Now". Case in warehouse facility design. 2016-2017 Material Handling Student Design Competition. College Industry Council in Material Handling Education. Sponsored by the Walt Disney Co., MHI and the Order Fulfillment Council. Co-developed with Matt Purcell. September 2016. Available at: [www.mhi.org/cicmhe/competition](http://www.mhi.org/cicmhe/competition).
- "OA Metal Fabrication". Case in manufacturing facility design. 2017-2018 Material Handling Student Design Competition. College Industry Council in Material Handling Education. Sponsored by the Overhead Alliance (Hoist Manufacturing Institute, Crane Manufacturers Association, Monorail Manufacturers Association), MHI and the Order Fulfillment Council. Co-developed with Karen Norheim. August 2017. Available at: [www.mhi.org/cicmhe/competition](http://www.mhi.org/cicmhe/competition).

- [Presentation] J.J. Ekong, D.M. Blersch, A.L. Carrano, K. Kardel. Three-dimensional substratum features increase biomass productivity in algal turf scrubber cultivation. 9th International Conference on Algal Biomass, Biofuels and Bioproducts. June 17-19th, 2019. Boulder, Colorado. (upcoming).
- [Poster] Tornese, F., Pazour, J.A, Carrano, A.L., Thorn, B.K. Improving the Environmental Sustainability of Pallet Logistics through Preemptive Remanufacturing: an Integer Linear Optimization Model. 15<sup>th</sup> International Material Handling Research Colloquium. July 23-26<sup>th</sup>, 2018. Savannah Georgia.
- [Poster] Gnoni, M.G., Tornese, F., Thorn, B.K., Pazour, J.A, Carrano, A.L. A Measurement Tool for Circular Economy Practices: a Case Study in Pallet Supply Chains. 15<sup>th</sup> International Material Handling Research Colloquium. July 23-26<sup>th</sup>, 2018. Savannah Georgia.
- [Presentation] "Design and Manufacture of 3D-Printed Substratum for Wastewater Treatment Processes". 2018 Universities Council on Water Resources and National Institute of Water Resources (UCOWR/NIWR). Annual Water Resources Conference. June 26-28, 2018. Pittsburgh, PA.
- [Presentation] "Effect of build orientation, material ratio, and part thickness on dimensional distortion in material jetting processes", Institute for Industrial and Systems Engineering Annual Conference (IISE 2018), Orlando, Florida. May 18-21, 2018.
- [Presentation] "Surface Metrology: a primer with some applications to biosystems engineering". Departmental seminar. Department of Biosystems Engineering. Auburn University. March 30<sup>th</sup>, 2017. Auburn, Alabama.
- [Presentation] "Applications of 3D-printed surfaces". Redstone Arsenal Additive Manufacturing Group. Prototype Integration Facility. AMRDEC. February 23, 2017. Huntsville, Alabama.
- [Poster] Application of high temperature thermoplastics to 3D printed hydroponics growth systems to improve sustainable food production capabilities to human space flight. IMAPS Advanced Technology Workshop. NASA. September 13-14, 2017. Huntsville, Alabama.
- [Poster] "Studies in surface engineering for controlling community structure in benthic algae cultivation". Research Faculty Symposium. September 22, 2017. Auburn University. Auburn, Alabama.
- [Keynote] "A bright future with 3D printing". American Society of Agricultural Engineering (ASABE). Alabama Section meeting. April 1<sup>st</sup>, 2016. Auburn, Alabama.
- [Presentation] "Additive manufacturing for investigating the effects of substratum topography on algal turf colonization and productivity under different nutrient concentrations". 2016 Annual Meeting of the American Society of Agricultural and Biological Engineers (ASABE). July 17-20, 2016. Orlando, Florida.
- [Poster] "Effects of substratum topography on algal turf productivity under different nutrient concentrations". 16<sup>th</sup> Annual Meeting of the American Ecological Engineering Society (AAES). June 6-9, 2016. Knoxville, Tennessee.
- [Poster] "Effects of substratum topography on algal turf productivity under different nutrient concentrations". 2016 Alabama Stormwater Symposium. May 10-12, 2016. Auburn, Alabama.
- [Tutorial] "Defects and quality assurance in additive manufacturing". NASA AAQ Workshop. NASA Training Center. September 1, 2015. Huntsville, Alabama.
- [Presentation] "Design of 3D printed substrata to enhance periphytic community colonization and productivity". 2015 Alabama Water Resources Conference and Symposium. September 9-11, 2015. Orange Beach, Alabama.
- [Poster] "Design of 3D printed substrata to enhance periphytic community colonization and productivity". 2015 Annual Meeting of the American Society of Agricultural and Biological Engineers (ASABE). July 26-29, 2015. New Orleans, Louisiana.

- [Presentation] "Application of surface roughness engineering principles to optimize benthic algae biofilm colonization and biomass characteristics". 2015 Annual Meeting of the American Society of Agricultural and Biological Engineers (ASABE). July 26-29, 2015. New Orleans, Louisiana.
- [Presentation] "Design of 3D printed substrata to enhance periphytic community colonization and productivity". 2015 Annual Meeting of the American Society of Agricultural and Biological Engineers (ASABE). July 26-29, 2015. New Orleans, Louisiana.
- [Presentation] "The shape of things to come: Reverse-engineering periphyton colonization processes using 3D printing". 2015 Annual Meeting of the American Ecological Engineering Society (AAES). June 6-9, 2015. Stillwater, Oklahoma.
- [Presentation] "Integrating CICMHE and MHI resources into the classroom". 2015 Material Handling Teachers Institute (MHTI 2015). July 13-17, 2015. University of Wisconsin Madison.
- [Presentation] "Preliminary development of 3D printed custom substrata for benthic algal biofilms". Industrial and Systems Engineering Research Conference (ISERC 2015). May 30- June 2, 2015. Nashville, Tennessee.
- [Presentation] "The impact of workforce variability on performance of U-shaped production lines". Industrial and Systems Engineering Research Conference (ISERC 2015). May 30- June 2, 2015. Nashville, Tennessee.
- [Presentation] "An experiential learning approach to problem solving for DHH students". Industrial and Systems Engineering Research Conference (ISERC 2015). May 30- June 2, 2015. Nashville, Tennessee.
- [Presentation] "Integration of experiential learning to develop problem solving skills in deaf and hard of hearing STEM students". 41st Annual Conference. The Association of College Educators: Deaf and Hard of Hearing (ACE-DHH) Annual Conference. St. Louis, Missouri. February 13th, 2015.
- [Workshop] "Experiential Education with Deaf and Hard of Hearing STEM students". Gallaudet University. Washington D.C. November 13th, 2013.
- [Workshop] "Designing sustainable pallet operations". Pan American Advanced Studies Institute (NSF – PASI) on Modeling, Simulation and Optimization of Globalized Physical Distribution Systems. Santiago, Chile. August 13, 2013.
- [Presentation] "Estimation of the cradle-to-grave CO2 footprint of wood pallets logistics operations". Industrial and Systems Engineering Research Conference, ISERC 2012. San Juan, Puerto Rico. May 18-22, 2013.
- [Presentation] "How to calculate carbon footprints: a wood pallet example". PROMAT Material Handling Show. Chicago, Illinois. January 21-24, 2013.
- [Presentation] "Order fulfillment education and efforts at U.S. universities". Order Fulfillment Solutions (OFS) Council. Material Handling Industry of America (MHIA) Annual Meetings. San Antonio, Texas. October 12-17, 2012.
- [Presentation] "Quick redesign of U-lines under unstable workforce environments". Cooper Seminar Series. Department of Industrial and Systems Engineering. Auburn University. September 24th, 2012.
- [Presentation] "Estimation of the cradle-to-grave CO2 footprint of wood pallets logistics operations". Center for Logistics and Distribution (LoDi). University of Louisville, KY. August 22nd, 2012.
- [Poster] "An MIP approach to the U-Line balancing problem with proportional worker throughput". International Material Handling Research Colloquium IMHRC 2012. June 25th-28th, 2012. Gardanne, France.
- [Poster] "Analysis of the environmental impact of wind turbine remanufacturing". American Wind Energy Association. WindPower 2012. Atlanta, Georgia. June 3-6, 2012.
- [Presentation] "Sustainability Metrics: how leading companies are measuring their environmental impact". Panel session. MODEX 2012 Supply and Logistics Expo. Atlanta, GA. February 7th, 2012.

- [Presentation] "Experiential Education: The Toyota Production Systems Laboratory". California Polytechnic State University. January 23rd, 2012. San Luis Obispo, CA.
- [Presentation] "Experiential Education: The Toyota Production Systems Laboratory". Material Handling Teachers Institute MHTI 2011. Auburn University. August 4th, 2011. Auburn, Alabama.
- [Presentation] "Environmental impact analysis of pallets management". International Symposium on Green Supply Chains. Kent State University. July 30th, 2010. Akron, Ohio.
- [Presentation] "A framework for designing electronics for end of life disposition". Industrial Engineering Research Conference, IERC 2010. June 5-9, 2010. Cancun, Mexico.
- [Invited presentation] "Sustainability in the U.S.A: changes in academic programs and government-funded research during 2000-2009". Japanese program in Science, Technology, Society and Policy (STSP). Tokyo, Japan. December 22, 2009
- [Invited presentation] "Integration of Sustainable Engineering into the Industrial Engineering Curriculum". (awarded first prize at the IIE Curriculum Innovation competition). 2009 Annual Industrial Engineering Conference. IIE-IERC. May 30-June 3, 2009. Miami, Florida
- [Invited panel]"Curricular innovation in sustainable engineering at RIT".. Engineers for a Sustainable World. 2008 Annual Conference. February 8-9, 2008. San Francisco, California.
- [Poster] "User-driven design of low-cost, low-impact solar ovens for rural populations in developing countries". International Solar Cookers Conference. July 11-15, 2006. Granada, Spain.
- [Presentation] "Incorporating sustainable design in the engineering capstone experience". The 2005 Engineers for a Sustainable World (ESW) Conference. October 5-9, 2005. Austin, Texas
- [Presentation] "Setup time reduction". Hardinge Seminar Series. Rochester Institute of Technology, Rochester, New York. May 18th, 2004
- [Presentation] "Design, implementation and integration of an experiential assembly system engineering laboratory module". 5th Annual Faculty Institute on Teaching and Learning (FITL): Communities of Practice. May 25-26, 2004. Rochester Institute of Technology. Rochester, New York.
- [Presentation] "Geometric modeling of microreplicated abrasive tooling on surface quality". Praxair Graduate Seminar Series. Department of Industrial Engineering. SUNY Buffalo. November 1, 2002. Buffalo, NY.
- [Keynote presentation] "Off-line quality control for optimization of manufacturing processes". IX Simposio de Ingenieria Industrial. Instituto Tecnologico Santo Domingo INTEC. August 22-25, 2002. Santo Domingo, Dominican Republic.
- [Keynote presentation] "Quantitative methods in material handling". III Jornadas de Ingenieria Industrial. Universidad Catolica Andres Bello. May 24-26, 1998. Caracas, Venezuela.
- [Presentation] "Characterization of Sanding Processes". Center for Abrasive Methods (CAM). 3M Corporation. St. Paul-Minneapolis, MN. October 1997.

## Funding and Support

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- Over \$1.75 MM of funded research activity from various agencies, including:
  - National Science Foundation (NSF)
  - National Aeronautics and Space Administration (NASA)
  - Environmental Protection Agency (EPA)
  - U.S. Department of Agriculture (USDA)
  - Material Handling Industry (MHI)
  - Toyota Motors Manufacturing
  - Toyota Foundation USA

- Gleason Foundation
- University-National Park Energy Partnership Program (UNPEPP)

### Workshops and Short Courses

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- Workshop on additive manufacturing (4-day). Funded by EAFIT University, Medellin, Colombia. (2016)
- Workshop on environmental pallet logistics (1-day). Pan American Advanced Studies Institute (NSF – PASI) on Modeling, Simulation and Optimization of Globalized Physical Distribution Systems. Santiago, Chile. Funded by the National Science Foundation. (2013).
- Workshop on streamlined life Cycle assessment (SLCA). (2-day). Funded by Hasbro, Inc. (2011).
- Dominican Republic faculty development workshop. (4-day). Funded by the Government of the Dominican Republic. (2011).
- New York State workforce development workshop. (5-day). Funded by the State of New York (Department of Labor through the Genesee Community College). (2011).
- Faculty development workshop in the Toyota Production Systems Lab. (5-day). Korean University of Technology and Education. Funded by the Government of South Korea. (2010).
- Workshop on streamlined life cycle assessment (SLCA) (3-day). Funded by Kodak. (2008)
- Workshop on manufacturing engineering in the Toyota Production Systems Lab. (2-weeks). Pontificia Universidad Catolica Madre Maestra, Dominican Republic. Funded jointly by the Government of the Dominican Republic and the Government of South Korea. (2003)
- Workshop on manufacturing engineering in the Toyota Production Systems Lab. (2-weeks) Universidad Catolica Andres Bello. Funded by participants. (2002)

### Teaching

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Lifetime evaluations:

- Georgia Southern University (2017- present): 4.56 (on a 5-point scale)
- Auburn University (2013 – 2017): 5.11 (on a 6-point scale)
- Rochester Institute of Technology (2000-2013): 4.10 (on a 5-point scale)
- Teaching awards: Outstanding Faculty Teaching Award (Auburn University, 2014), Excellence in Teaching Lean Award (IIE, 2010), Curriculum Innovation Award (IIE, 2009), Eisenhart Finalist for Teaching Excellence (RIT, 2003).

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**Georgia Southern University (2017 – present)**

<b>Course name (G=graduate, UG=undergraduate, O=online/outreach)</b>	<b>Number of times delivered (number of lab sections)</b>	<b>Average Enrollment</b>	<b>Instructor's Evaluation</b>
Product Engineering and Design (UG)	1 (1)	20	4.56 / 5.00

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**Auburn University (2013 – 2017)**

<b>Course name (G=graduate, UG=undergraduate, O=online/outreach)</b>	<b>Number of times delivered (number of lab sections)</b>	<b>Average Enrollment</b>	<b>Instructor's Evaluation</b>
Manufacturing Systems I (UG)	4 (25)	96	5.19 / 6.00
Additive Manufacturing (UG, G)	3 (0)	39	5.00 / 6.00
Manufacturing Floor Control (UG, G, O)	2 (0)	62	5.19 / 6.00
Manufacturing Systems II (UG)	1 (0)	98	5.00 / 6.00
Senior Design (UG)	4 (0)	7	N/A
Graduate Seminar (G, O)	1 (0)	69	N/A

**Rochester Institute of Technology (2000 – 2013)**

<b>Course name (G=graduate, UG=undergraduate, O=online)</b>	<b>Institution</b>	<b>Number of times delivered</b>	<b>Instructor's Evaluation</b>
Facilities Planning (UG)	Rochester Institute of Technology	13	3.98 / 5.00
Manufacturing Systems (G, O)	Rochester Institute of Technology	12	4.43 / 5.00
Design of Production Systems (UG)	Rochester Institute of Technology	6	4.36 / 5.00
Design for the Environment (G)	Rochester Institute of Technology	6	4.14 / 5.00
Production Control (UG)	Rochester Institute of Technology	3	4.33 / 5.00
Operations Research II (UG)	Rochester Institute of Technology	3	---
Manufacturing Engineering (UG)	Rochester Institute of Technology	3	---
Management of Quality (G)	Rochester Institute of Technology	2	---
Statistical Quality Control (UG)	Rochester Institute of Technology	2	---
Production Control (G)	Rochester Institute of Technology	1	4.54 / 5.00
Global Facilities Planning (G)	Rochester Institute of Technology	1	---
Reliability Engineering (G)	Rochester Institute of Technology	1	---
Metrology in Manufacturing (G)	Rochester Institute of Technology	1	---

--- Not taught since 2006

**International universities**

<b>Course name (G=graduate, UG=undergraduate, O=online)</b>	<b>Institution (location)</b>	<b>Number of times delivered</b>	<b>Instructor Evaluation</b>
Manufacturing Systems (G, O)	Yeditepe University (Turkey)	2	N/A
Design for the Environment (G)	Kanazawa Institute of Technology (Japan)	1	N/A
Intro to Sustainable Engineering (G)	Yeditepe University (Turkey)	1	N/A

Summary of graduate (G) and Undergraduate (UG) student advising.

Auburn University (2013 – 2017)

- Doctoral students (completed): 4
- Doctoral students (committee member): 5
- Master thesis (committee member): 2
- UG Senior Design Teams (4-5 students each): 4
- UG Honor research theses: 1

Rochester Institute of Technology (2000 – 2013).

- Master thesis (completed, as chair/major advisor): 12
- Master thesis (committee member): 11
- Master of engineering capstone: 20
- Master of Manufacturing Leadership capstone: 16
- Honors research teams (5 students each): 2
- Multidisciplinary senior design teams (5-6 students each): 7

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**Doctoral dissertation committees (chair - *completed*)**

<b>Graduate Student</b>	<b>Dissertation title</b>	<b>Graduation date</b>	<b>Placement</b>
Dr. Kamran Kardel	3D-printed substrata for benthic algae attachment	08/2016	Assistant Professor Georgia Southern University
Dr. Joseph Ekong	Effect of three dimensional substratum features on benthic algal biomass productivity	12/2017	Assistant Professor Western New England University
Dr. Ali Khoshkhoo	Design and manufacture of surface topography with additive manufacturing: properties and applications	08/2018	Assistant Professor State University New York SUNY Binghamton
Dr. Gabriel Proano	3D-printed custom substratum to accentuate fast functional responses from microbiological colonization	12/2018	TBD

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**Doctoral dissertation committees (*member and reader*)**

<b>Graduate Student</b>	<b>Dissertation title</b>	<b>Graduation date</b>
Mauricio Henriquez	Topic on 3D printing of conductive filaments via fused deposition modeling	2020 - <i>expected</i>
Hamid Ghaednia	Process characterization of 3D substrata for sustainable treatment processes	2017
Hung-Yu (Jack) Lee	Facility layout and emerging advanced material handling optimization	2017
Chaobo Shen	Reliability of aging microstructures for Sn-Ag-Cu solder joints during thermal cycling.	2016
Zhou Hai	Reliability of lead-free electronic package interconnections under harsh environmental conditions.	2014

**Master of science thesis committees (Chair - *completed*)**  
**[highlight indicates Sustainable Engineering Master Program]**

<b>Student</b>	<b>Thesis title</b>	<b>Year</b>	<b>Placement</b>
Bhairav Mehta	Response surface methodology of die-sink EDM surfaces.	2002	Cornell University / Apple
Hitesh Kataria	Modeling of tooling-workpiece interactions with engineered abrasives	2003	Lord and Co.
Bhavin Vora	Computer vision-based monitoring of abrasive loading in wood machining.	2005	Fairchild Semiconductors
Guillermo Lopez	Generalized construction of trend-resistant 2-level split plot designs.	2007	Goya Foods
Chris Wood	Environmental impacts of waste vegetable oil collection for use as biodiesel.	2007	Toyota
Reyhan Erin	MIP model to U-line balancing problems for proportional worker throughput.	2007	Magna Powertrain
Jorge Daccarett	Environmental impact of demand variability in beverage supply chains	2009	SPX Corporation
Ainoa Mazeika	Environmental impact analysis of alternative pallet management systems.	2011	Cummins Engines
Carlos Briceno	Design framework for environmental trade-offs in product development.	2012	Toyota Technical Center
Arvind Sridharan	High pressure coolant on PVD coated inserts during end milling of Ti-6Al-4V.	2012	Liberty Pumps
Manuel Sosa	Environmental impact of wind turbines remanufacturing operations	2012	Bausch and Lomb
Srinath Sriram	A novel work-sharing protocol for U-shaped assembly lines (*)	2013	Danaher - Qualitrol

(\*) Awarded RIT's "2013 Best Research Thesis Award"

**Master of science thesis committees (member)**

<b>Student</b>	<b>Thesis title</b>	<b>Graduation date</b>
Derek J. Schmitt	Experimental investigation of surface roughness microstructures and their effects on pressure drop characteristics in rectangular microchannels	2004
Kyle Hurst	Making sustainable and environmental improvements through focused factories	2006
Ming Hong	Solution strategies for a supply chain deterministic model	2007
Alvaro Rojas	A selection framework for derivative products: development of an impact metric and platform value assessment methodology	2008
Krishna Kamath	Design for assembly line performance: the link between DFA metrics and assembly line performance metrics	2009
Lionel Senyana	Environmental impact comparison of distributed and centralized manufacturing scenarios	2011
Ashley DeVierno	Determining a relationship between design characteristics and end-of-life disposition of cellular phones	2011
Xi Zhou	Design and development of a sustainability toolkit for simulation modeling analysis	2011
Tejas Bendarkar	Characterization of modeling of pneumatic multi-material micro-extrusion	2012
Johanna Bentley	Modeling a solar-heated anaerobic digester for the developing world using system dynamics	2012
Xiaohan Zhang	An analysis of the multiscale structure of rough surfaces	2014
Christian Lopez	Unbalanced workload allocation in large assembly lines	2014
Manjinder Kaur	Effect of substratum topography on algal turf colonization and productivity under different nutrient conditions	2016



Awards to students and student groups [under direct supervision]

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- Paper of the Year Award (2018). Journal of Contemporary Water Research and Education. University Council on Water Resources (UCOWR) and National Institute for Water Resources (NIWR). Awarded to: Olivia Elliott, Stephanie Gray, Michael McClay, Bakr Nassief, Ann Nunnelley, Eric Vogt, Joseph Ekong, Kamran Kardel, Ali Khoshkhoo, Gabriel Proaño.
- 2016 Master Thesis Research Award. Graduate School. Auburn University Awarded to Manjinder Kaur. Co-advised with Dr. David Blesch (Committee Chair).
- First place award. 2016 EPA-P3 National competition. U.S. Environmental Protection Agency. Washington, DC. (awarded to Olivia Elliott, Ann Nunnelley, Zane Trott Jr. Michael McClay, Bakr Nassief, Stephanie Gray, Eric Vogt).
- Honorable mention poster award. Graduate Engineering Research Showcase (2014). Ginn College of Engineering at Auburn University. Awarded to Joseph Ekong.
- "2013 Best Research Thesis Award" awarded to Srinath Sriram by the Department of Industrial and Systems Engineering at RIT.
- Engineers for a Sustainable World. First Prize. San Diego Inner-Chapter Solar RC Vehicle Challenge (2012). (awarded to: John Wilson and Pieter Werner).
- Fidelity Investments Prize. (2008). RIT Innovation Festival. (awarded to: James Barnum, Alicia Tejada, Carlos Briceno, Alvaro Rojas, Hemanth Bharadwaj, Mariela Rodriguez, Manaal Eisa, Megan Murat and Pamela Tham).
- First place award. 2005 EPA-P3 National competition. U.S. Environmental Protection Agency. Washington, DC. (awarded to Emma Fulton, Topher Wood, Carlos Plaz, Otman ElAllam, Jonathan Steiner, and Natalya Privorotskaya).
- National Material Handling Design Competition (MHIA - CICMHE).

Year	Placement	Undergraduate Students
2013	1 <sup>st</sup>	Margaret Bates, Jessica Jeffrey, Alexandra Wodward
2012	1 <sup>st</sup>	Austin Chacosky, Bridget Eggers, Matthew Myers, Leila Rozenman
2009	3 <sup>rd</sup>	José Rodríguez, Rodrigo Velarde, Huseyin Zorba and Desirae Gilbert
2008	2 <sup>nd</sup>	Lindsay Powers, Joshua Monsees, Leonardo Gala and Andrew Lawlor
2006	Honorable mention	James Letts, Nicolette McGeorge, Jessica Stalker, and Greg Tauer
2005	Honorable mention	David Blonski, Sean Carmody, Matthew Klosner, and Sagar Sheth
2004	3 <sup>rd</sup>	Jason Kistner, Sarah Ballard, Joshua Dennie, and Emily Johnson

Service [Professional Organizations and Industry]

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- Campus Representative. Federal Demonstration Partnership (FDP). (2018-present).
- College Industry Council in Material Handling Education (CICMHE). MHI.
  - Liaison to the Board of Governors (2018-present)
  - Past-President (2016-2017)
  - President (2014-2015).
  - Vice-president (2012-2013).
  - Chair of the Events committee (2010-2011).
  - Academic Board member (2008-2011).

- International Material Handling Research Colloquium (IMRHC).
  - Scientific Committee member. XVI IMHRC (TBD 2020).
  - Scientific Committee member. XV IMHRC (Savannah, Georgia. 2018).
  - Scientific Committee member. XIV IMHRC (Karlsruhe, Germany. 2016).
  - Scientific Committee member. XII IMHRC (Gardanne, France. 2012).
- International Conference on Surface Metrology (ICSM).
  - Scientific Committee member. 6<sup>th</sup> ICSM. (Poznan, Poland. 2016).
  - Scientific Committee member. 3<sup>rd</sup> ICSM. (Mont Blanc, France. 2012).
  - Scientific Committee member. 2<sup>nd</sup> ICSM. (Worcester, MA. 2010).
  - Scientific Committee member. 1<sup>st</sup> ICSM. (Worcester, MA. 2009).
- ANSI ICWM-201X Standard Canvass committee member (2017).
- Institute of Industrial Engineering (IIE). Lean division. Board of Directors member (2012-2013). Director of newsletters (2013).
- Several ad-hoc committees. Material Handling Education Foundation (MHEFI) (2008-present).
- National Science Foundation panelist / reviewer (multiple occasions).
  - CCLI, TUES, GOALI, Graduate Research Fellowship program (GRFP)
- ANSI Committee on Education. Member (2012-2013).
- Associate Editor: Journal of Transportation Technologies (2012-2014).
- Technical Reviewer. U.S. Department of Agriculture. Cooperative State Research, Education and Extension Services (USDA-CSREES). (2000-2005)
- Professional Memberships:
  - Institute of Industrial Engineers IIE (senior member). (1995 - present)
  - Society of Manufacturing Engineering SME (senior member). (1997 - present)
  - American Society of Engineering Education ASEE (member). (2000 - present)
- Consulting, training workshops and other technical assistance:
  - Green Acres Project - Hartsfield Jackson Atlanta Airport
  - Kodak
  - Bausch and Lomb
  - Xerox
  - Webster Plastics
  - Toyota
  - MHI
  - Hasbro
  - Pliant Corp.

#### Service [Academic]

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- Georgia Southern University (2017 – present)
  - College Strategic Planning committee (Chair, 2018-2019)
  - Intellectual Property committee (2018-present).
  - College Promotion and Tenure Committee (2017-present).
  - University Research Committee (2017-present).
  - Coordinator of Faculty Seed Research Grant program (2017-present)
  - Coordinator of Student Research Award program (2017-present)
  - Search Chair
    - Civil Engineering Department Chair (2018-2019)

- Director of Industrial Relations (2017-2018)
  - Search committee member:
    - 5 Manufacturing Engineering assistant professors (2017-2018)
- Auburn University (2013 – 2017)
  - PhD. Admissions committee (2015-present).
  - Faculty Search Committee (2014 -2015, 2015-2016).
  - Faculty advisor. Auburn 3D Printing club and makerspace.
  - Judge. Graduate engineering research showcase (2013, 2014, 2015).
  - Judge. Chemical engineering freshman competition (2013).
- Rochester Institute of Technology (2000 – 2013)
  - Toyota Production Systems Lab, RIT. Director. (2006-2013).
  - Brinkman Machine Tools Lab, RIT (Director 2002-2006)
  - University-level Tenure Committee (UTC). (Chair 2011-2012).
  - RIT College of Engineering Tenure Committee. (member 2008-2011 , Chair 2011-2012).
  - Faculty Search committees, RIT (2002, 2007 (chair), 2009 Endowed Professor (chair)).
  - National Technical Institute for the Deaf (NTID). (Academic Senate representative, 2012-2014)
  - Engineering for a Sustainable World student chapter, RIT. Founding co-advisor. (2005-2013).
  - Coordinator. ISE Seminar Series, RIT (2001-2003).
  - College of Engineering Academic Conduct Committee (2011-2014).
  - College of Engineering Faculty Development Grants Committee (member 2008-20011, Chair 2012)
  - International Education Committee institute-level workgroup (2010-2012).
  - Long Range Planning. Academic Senate Standing Committee. (Co-Chair, 2007-2010).
  - Teaching Assessment Committee - ad-hoc. (2007-2008).
  - Teaching and Learning Center. Member of the advisory board. (2002-2008).
  - Strategic Planning. Global Dimensions Taskforce. (2003-2004).
  - College of Engineering Honors Committee – ISE advocate (2002-2004).
- Sponsored Scholars
  - Dr. Brian K. Thorn (Rochester Institute of Technology, NY). 2018
  - Dr. Alvaro Rojas-Arcieniegas (Universidad Occidente, Colombia). 2015
  - Dr. Fabiana Tornese (University of Salento, Italy). 2015
  - Dr. Enrico Cagno (Politecnico di Milano, Italy). 2008
  - Dr. Shyam Nandwani (Universidad Nacional, Costa Rica). 2006

#### Service [Reviewing and Editing]

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- Technical Reviewer for the following journals:
  - Journal of Cleaner Production
  - International Journal of Production Economics
  - Rapid Prototyping
  - Computers and Industrial Engineering
  - Journal of Manufacturing Systems.
  - PLoS ONE
  - ASME Journal of Tribology
  - ASTM Smart and Sustainable Manufacturing Systems

- SME NAMRC
  - Forest Products Journal
  - Scanning: the journal of scanning microscopy
  - Algorithms
  - Journal of Engineering for Sustainable Development
  - Journal of Green Building
  - Bioresources Journal
  - International Journal of Business Performance Management.
  - Proceedings of the Institution of Civil Engineers – Engineering Sustainability
  - Journal of Enterprise Transformation
  - International Journal of Sustainable Engineering
  - Computational Intelligence and Neuroscience
- Associate Editor (Books).
    - Progress in Material Handling Research. Volume XV. (2018). Ballot, E., Carrano, A.L., Ellis, K.P., Ferrell, W., Porter, J.D., Reed, D. (Eds). [https://digitalcommons.georgiasouthern.edu/pmhr\\_2018/](https://digitalcommons.georgiasouthern.edu/pmhr_2018/).
    - Progress in Material Handling Research. Volume XII. (2012). Montreuil, B., Carrano, A.L., Gue, K., de Koster, R., Ogle, M., Smith, J (Eds). 729 pages. ISBN: 978-1-882780-17-5.
  - Chapter Editor.
    - Chapter 11: Metrology and Inspection. De Garmo’s Materials and Processes in Manufacturing. 12th Edition. (2017) JT Black, and Ronald A. Kosher. Wiley. 864 pages. ISBN: 978-1-118-98767-4.
  - External reviewer in tenure and full promotion cases at Oregon State University, Texas State University, and Auburn University.
  - Reviewer of several books on facilities planning and environmental material selection.
  - IIE Industrial Engineering Research Conference. Session chair and paper reviewer (multiple occasions).
  - ASME International Design Engineering Technical Conference (DETC). Paper reviewer (multiple occasions)

#### Service [Conference Leadership]

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- International Material Handling Research Colloquium (IMHRC 2018). July 2018. Savannah, Georgia.
- Material Handling Teachers’ Institute (MHTI). June 2013.
  - Organized and hosted 45 faculty and industry people for a week long camp in material handling educational methods and best practices.
- IIE Lean Six Sigma Conference. September 2013. Atlanta, GA. Program committee member.
- International Summer Program in Manufacturing
  - Founding Coordinator. Rochester Institute of Technology. (2001, 2002, 2008). Organized and hosted a 3-week session for international students in manufacturing. Total attendance = 93 students.
  - Founding Coordinator. North Carolina State University. (2000, 2001). Organized and hosted a 3-week camp for international students in manufacturing. Total attendance = 65 students.

## Training and Certifications [Manufacturing]

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- Eco-Audit and Life Cycle Assessment. Cambridge Engineering Materials Selector (CES).
- Omron Programmable Logic Controllers NJ-series and Sysmac.
- Pick-to-Light Control and Programming – Lightning Pick.
- Toyota Production System training (by location).
  - Toyota TMMK (Erlanger, Kentucky): TPS Fundamentals, A3 Problem Solving.
  - Toyota Powertrain Dojo (Georgetown, Kentucky): Automotive safety.
  - Toyota TMMI (Princeton, Indiana): Iterative Kaizen.
  - NAPSC North America Production Support Center (Georgetown, Kentucky): Train-the-trainer.
- Factory software suite (FactoryCAD, FactoryFLOW, FactoryPLAN)
- MasterCAM
- Cambridge Engineering Materials Selector (CES).
- Certified Manufacturing Technologist (Society of Manufacturing Engineering) 1999-2003

## Identifiers and Sites

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- Bepress Selected Works: <https://works.bepress.com/andres-carrano/>
- PlumX: <https://plu.mx/georgiasouthern/u/sw-andres-carrano>
- Publons: [publons.com/a/1408193/](https://publons.com/a/1408193/)
- Academic Tree: <https://academictree.org/etree/tree.php?pid=586357>
- Google scholar profile: <https://scholar.google.com/citations?user=maOmDjIAAAAJ&hl=en&oi=ao>

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