

# Neal D. Lawrence

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## Education

### University of Illinois at Urbana-Champaign

*Ph.D. Mechanical Engineering*, expected August 2016

Research: Experimental investigation of off-design operation of transcritical CO<sub>2</sub> ejectors

Advisor: Professor Stefan Elbel

GPA: 3.9/4.0

*M.S. Mechanical Engineering*, December 2012

Thesis: Experimental investigation of two-phase ejector cycle using R134a and R1234yf

Advisors: Professor Stefan Elbel, Professor Pega Hrnjak

### University of Wisconsin – Madison

*B.S. Mechanical Engineering*, May 2010

GPA: 3.7/4.0; College of Engineering Dean's List (8 of 8 semesters)

## Research

### Graduate Research Assistant, January 2011 – present.

*Part-load and off-design operation of two-phase ejectors in transcritical CO<sub>2</sub> systems*

- Devised and evaluated ejector cycle control strategies to achieve high cycle efficiency over range of cycle conditions and capacities.
- Constructed transcritical CO<sub>2</sub> ejector facility for experimental evaluation of ejector control strategies including multiple ejector arrangements and adjustable ejectors.

*Experimental and numerical investigation of liquid recirculation cycles with ejectors*

- Experimentally investigated and compared the performance of liquid recirculation cycles with and without ejectors using R410A.
- Developed finite-volume numerical model to investigate the effect of microchannel evaporator geometry on performance of ejector cycles for a range of fluids.

*Experimental investigation of automotive two-phase ejector cycle using R134a and R1234yf*

- Modified an experimental automotive air conditioning system to a two-phase ejector system; operated and collected data with system using R134a and R1234yf.
- Designed and tested R134a ejectors with different geometries at varying conditions.

## Teaching Experience

### Grading Teaching Assistant, August 2013 – December 2014.

- Provided feedback to students on their assignments for graduate level thermal science courses.
- Taught several lectures of graduate level refrigeration and air conditioning and thermal systems design courses.

### Graduate Teaching Assistant, August 2010 – May 2011.

- Made "List of Teachers Ranked as Excellent by Their Students" Fall 2010, Spring 2011 semesters.
- Earned "Graduate Teacher Certificate"; made effort to review and improve teaching.

## Industry Experience

### Engineering Intern, Alliant Energy, May 2009 – January 2010.

- Gained experience with the different equipment and processes involved in the operation and maintenance of a pulverized coal power plant.
- Coordinated and managed various projects at power plant.

**Professional Activities**

**Technical Journal Reviewer**, 2013 – present.

- Reviewed submitted manuscripts considered for publication in *International Journal of Refrigeration*, *Applied Thermal Engineering*, and *Applied Energy*.

**Member:** IIR, ASHRAE, SAE

**Skills**

**Programming:** EES, Matlab, FORTRAN

**Software:** Microsoft Office, SolidWorks, Pro ENGINEER, Agilent VEE Pro, NI LabVIEW

**Publications and Presentations****Journal Publications**

- Lawrence, N., Elbel, S., 2015. Analysis of two-phase ejector performance metrics and comparison of R134a and CO<sub>2</sub> ejector performance. *Science and Technology for the Built Environment*, Accepted Manuscript.
- Lawrence, N., Elbel, S., 2014. Experimental investigation of a two-phase ejector cycle suitable for use with low pressure refrigerants. *International Journal of Refrigeration* 38(1): 310-322.
- Lawrence, N., Elbel, S., 2013. Theoretical and practical comparison of two-phase ejector refrigeration cycles including First and Second Law analysis. *International Journal of Refrigeration* 36(4): 1220-1232.

**Selected Conference Publications**

- Lawrence, N., Elbel, S., 2015. Numerical investigation of the effect of microchannel evaporator design on the performance of two-phase ejector automotive air conditioning cycles. SAE Technical Paper 2015-01-0362, Accepted Manuscript.
- Lawrence, N., Elbel, S., 2014. Numerical investigation of two-phase ejector liquid recirculation cycles with natural refrigerants. 11<sup>th</sup> IIR Gustav Lorentzen Conference on Natural Refrigerants, Hangzhou, China, Paper 52.
- Lawrence, N., Elbel, S., 2014. Review and analysis of the effect of ejector geometry on the performance of two-phase CO<sub>2</sub> ejectors. 11<sup>th</sup> IIR Gustav Lorentzen Conference on Natural Refrigerants, Hangzhou, China, Paper 53.
- Lawrence, N., Elbel, S., 2014. Experimental and numerical study on the performance of R410A liquid recirculation cycles with and without ejectors. 15<sup>th</sup> International Refrigeration and Air Conditioning Conference at Purdue, West Lafayette, IN, USA, Paper 2187.
- Lawrence, N., Elbel, S., 2014. Analysis and comparison of two-phase ejector performance metrics for R134a and CO<sub>2</sub> ejectors. 15<sup>th</sup> International Refrigeration and Air Conditioning Conference at Purdue, West Lafayette, IN, USA, Paper 2188.
- Lawrence, N., Elbel, S., 2014. Comparison of CO<sub>2</sub> and R134a two-phase ejector performance for use in automotive air conditioning applications. SAE Technical Paper 2014-01-0689.
- Lawrence, N., Elbel, S., 2013. Experimental and analytical investigation of two-phase ejector air-conditioning cycles using low-pressure refrigerants R134a and R1234yf. SAE Technical Paper 2013-01-1495.

**Invited Presentations**

- Ejector expansion devices to improve capacity and COP. Presentation at Shanghai Jiao Tong University, Sept. 4<sup>th</sup>, 2014.