

**OBJECTIVE:**

To obtain a full-time position with a leading edge organization in the field of multidisciplinary research.

**PROFILE:**

Mechanical-Electrical Engineer with cross-discipline experience. In-depth understanding of Digital Signal Processing and Image Analysis as applied to Infrared Thermography for NonDestructive Testing and Evaluation. Strong background on Heat Transfer processes, Thermodynamics and Statistical Analysis of Multivariate data.

**AREAS OF EXPERTISE:**

**Nondestructive Testing and Evaluation (NDT&E) by Infrared Thermography (IT)**

- ◆ Qualitative and quantitative techniques in active thermography.
- ◆ Complex shape inspection: non-planar forms, oriented surfaces.
- ◆ Thermal modeling: homogeneous materials and anisotropic composites.

**Digital signal processing and image analysis**

- ◆ Signal processing with the discrete Fourier Transform.
- ◆ Infrared image acquisition and processing.
- ◆ Image analysis in the presence of noise.

**Heat transfer**

- ◆ Experimental determination of the convective heat transfer coefficient.
- ◆ Thermal radiation principles.
- ◆ Heat conduction through solids.

**Statistical analysis**

- ◆ Principal Component Analysis (PCA).
- ◆ Multivariate modeling by Partial Least Squares regression (PLS).

**EDUCATION:**

- 2005 **Ph. D. Electrical Engineering** Université Laval, Quebec (Quebec) Canada.  
*Developed a subsurface defect depth inversion procedure using phase delay data obtained by Pulsed Phase Thermography.*  
Supervisor: Xavier MALDAGUE, Chairman, Department of Electrical and Computer Engineering, Université Laval, Quebec (PQ) Canada, G1K 7P4.  
Phone: +1(418) 656-2962, Fax:+1(418) 656-3594.
- 2000 **M. Sc. Mechanical Engineering** Université Laval, Quebec (Quebec) Canada.  
*Studied the sensible and latent thermal characteristics of an air-to-air heat exchanger in the presence of corrugated surfaces and condensation.*  
Supervisor: Daniel ROUSSE (current position and address), Vice-rector, Levis Campus, Université du Quebec à Rimouski, 55, rue du Mont-Marie, Levis (Quebec) G6V 8R9. Phone: +1(418)833-8800 ext. 333, Fax: +1(418)833-1113.
- 1996 **B. Sc. Mechanical Engineering** Universidad Regiomontana, Monterrey (Nuevo Leon) Mexico.

## EXPERIENCE:

*September 2000 to July 2001* **Research Engineer**, Laboratoire de physico-chimie et génie alimentaire, École nationale supérieure d'agronomie et d'industries alimentaires (ENSAIA), Institut National Polytechnique de Lorraine (INPL), Nancy (Lorraine) France.

- ♦ Responsible for conducting research, prepare technical reports and expose monthly briefings in two major projects directly related to the industrial partners cited below.
- ♦ Investigated the potential of paper as a packaging material for chocolate bars and cookies applying Principal Component Analysis (PCA) on sensory data. For Ahlstrom Paper Group, Pont Evêque, France.
- ♦ Developed a multivariate quality prediction model for peaches and apples by Partial Least Squares regression (PLS) using physico-chemical and sensory data. For the Ctifl (Inter-professional technical center of fruits & vegetables), Paris, France.

Supervisor: Stéphane DESOBRY, Laboratory Director, ENSAIA-INPL, 2, avenue de la Forêt-de-Haye, 54500 Vandœuvre-lès-Nancy, France.

Phone : +33 (0)3 83 59 58 80, Fax : +33 (0)3 83 59 58 04.

*January 1997 to July 2000* **Graduate Assistant**, Mechanical Department, Laval University, Quebec (PQ) Canada.

- ♦ Designed and constructed a data acquisition system for the characterization of a cylindrical water reservoir to be used as a bat shelter heating source.
- ♦ Elaborated two manual guides for Radiation and Convection laboratory courses.
- ♦ Surveyed and corrected exams on heat transfer courses.

Supervisor: Daniel ROUSSE (current position and address), Vice-rector, Levis Campus, Université du Quebec à Rimouski, 55, rue du Mont-Marie, Levis (Quebec) G6V 8R9.

Phone: +1(418)833-8800 ext. 333, Fax: +1(418)833-1113.

*January 1999 to January 2000* **Research Engineer**, CIDES- Experimental Development and Information Center in Greenhouse Crops, Saint-Hyacinthe (PQ) Canada.

- ♦ Participated, as part of a group of 6 researchers from three different organizations: Université Laval, the Ministère de l'Agriculture, des Pêcheries et de l'Alimentation du Québec (MAPAQ) and the Centre d'Information et Développement Expérimental en Sericulture (CIDES), on the investigation of an experimental air-to-air heat exchanger to be used on greenhouse dehumidification.
- ♦ Designed and constructed a heat exchanger prototype for the experimental characterization of a heat exchanger used on greenhouse dehumidification.

Supervisor: François LÉVEILLÉE, Project responsible, CIDES, 3230 Sicotte, St-Hyacinthe, Quebec (Quebec) Canada, J2S 2M2. Phone: (450)-778-3492, Fax:(450)-778-3621.

*Summer Internship 1994* **Assistant Engineer**, Cervecería Cuauhtémoc-Moctezuma, Toluca, (Estado de Mexico) Mexico.

- ♦ Analyzed, proposed and implemented correcting procedures to reduce the energy consumption on beer production lines, vapor conduits and warehouses illumination.

## OTHER QUALIFICATIONS:

*Scholarships and awards:*

- Quebec Excellency Scholarship Program - PQBE, from 1997 to 2000.
- Recognition for the high notes (Autumn 1995 - Regiomontana University).

*Computer skills:*

- MatLab, The UNSCRUMBLER, SYSTAT
- Windows XP/2000/ME/98/95/NT.
- MS Office: Word, Excel, and Power Point.
- Internet Explorer, Netscape, FTP.

- Languages:**
- English: scientific writing, speaker at several international conferences, co-chaired two sessions at the WCNDT'04 in Montreal.
  - French: 9 years living in French speaking environment, M. Sc. and Ph. D. studies in Quebec, 10 months work experience in France.
  - Spanish: native, scientific writing.

- Affiliations :**
- ASME (since 2000).
  - IEEE (since 2002).
  - SPIE (since 2004).

## **PUBLICATIONS:**

### **Thesis**

Ibarra-Castanedo C. "Quantitative Subsurface Defect Evaluation By Pulsed Phase Thermography: Depth Retrieval with the Phase," *Ph.D. Thesis*, Laval University. *in course*

Ibarra-Castanedo C. "Caractérisation expérimentale des échanges sensibles et latents dans un échangeur de chaleur à contre courant pour la gestion de l'humidité dans des serres," *M.Sc. Thesis*, Laval University, 2000. *in French*

### **Refereed Journal Papers**

- \* Ibarra-Castanedo C., Avdelidis N. P., Grinzato E. G., Bison P.G., Marinetti S., Liu C. Genest M. and Maldague X. "Quantitative Inspection of Complex Shape Composite Specimens by Pulsed Phase Thermography," *Qirt Journal*. *submitted*
- [1] González D. A., Ibarra-Castanedo C., Madruga F. J. and Maldague X. "Differentiated Absolute Phase Contrast Algorithm for the Analysis of Pulsed Thermographic Sequences," *Infrared Physics and Technology*, 2005. *in press*
  - [2] Ibarra-Castanedo C., Avdelidis N. P. and Maldague X. "Quantitative assessment of steel plates using pulsed phase thermography," *Materials Evaluation*, 2005. *in press*
  - [3] Ibarra-Castanedo C. and Maldague X. "Interactive Methodology for Optimized Defect Characterization by Quantitative Pulsed Phase Thermography," *Research in Nondestructive Evaluation*, **16**(4):1-19, 2005.
  - [4] Ibarra-Castanedo C., González D., Klein M. Pilla M., Vallerand S. and Maldague X. "Infrared Image Processing and Data Analysis," *Infrared Physics and Technology*, **46**(1-2):75-83, 2004.
  - [5] Ibarra-Castanedo C. and Maldague X. "Pulsed Phase Thermography Reviewed," *QIRT Journal*, **1**(1):47-70, 2004.
  - [6] Avdelidis N. P., Ibarra-Castanedo C., Maldague X., Marioli-Riga Z. P. and Almond D. P., "A Thermographic Comparison Study for the Assessment of Composite Patches," *Infrared Physics and Technology*, **45**(4):291-299, 2004.
  - [7] Avdelidis N. P., Almond D. P., Dobbins A. and Hawtin B. C., Ibarra-Castanedo C., Maldague X. Invited Review Paper: "Aircraft composites assessment by means of transient thermal NDT", *Progress in Aerospace Sciences*, **40**(3):143-162, 2004.
  - [8] Ibarra-Castanedo C., Jacquet P. and Rouse D. R. "Intercambiador de calor para el control de humedad en invernaderos," *Ciencia UANL*, **4**(1):63-68, 2001. *in Spanish*

### **Refereed Conference Proceedings**

- \* Ibarra-Castanedo C., González D., Galmiche F., Maldague X. P. and Bendada A. "Discrete signal transforms as a tool for processing and analyzing pulsed thermographic data," *Proc. SPIE - The International Society for Optical Engineering, Thermosense XXVIII*, Orlando, FL, 2006. *abstract submitted*
- [9] Ibarra-Castanedo C., González D., Bendada H. and Maldague X. "Análisis de imágenes en Termografía Infrarroja," *Proc. X Simposio de Tratamiento de Señales, Imágenes y Visión Artificial*, available in CD, Cali, Colombia, September 14-16, 2005. *in Spanish*.
  - [10] Avdelidis N. P., Ibarra-Castanedo C., Kouli M., Maldague X. and Moropoulou A. "Thermography Approaches on Plastered Mosaics," *8<sup>th</sup> International Workshop on Advanced Infrared Technology and Applications (AITA 8)*, Rome, Italy, September 7 - 10, 2005. *in press*.
  - [11] Genest M., Grinzato E., Bison P., Marinetti S., Ibarra-Castanedo C. and Maldague X. "Shape Effect on Blind Frequency for Depth Inversion in Pulsed Thermography," *5<sup>th</sup> International Workshop*

*Advances in Signal Processing for Non Destructive Evaluation of Materials (IWASPND E)*, Université Laval, Quebec City (Quebec) Canada, 2-4 August, 2005. *in press*.

- [12] González D. A., Ibarra-Castanedo C., López-Higuera J. M., and Maldague X. "New Algorithm based on the Hough Transform for the Analysis of Pulsed Thermographic Sequences," *5<sup>th</sup> International Workshop Advances in Signal Processing for Non Destructive Evaluation of Materials (IWASPND E)*, Université Laval, Quebec City (Quebec) Canada, 2-4 August, 2005. *in press*.
- [13] Ibarra-Castanedo C. and Maldague X. "Pulsed Phase Thermography Inversion Procedure using Normalized Parameters to Account for Defect Size Variations," *Proc. SPIE - The International Society for Optical Engineering, Thermosense XXVII*, **5782**:334-341, Orlando, FL, 2005. *25 min. oral presentation*
- [14] Ibarra-Castanedo C. Avdelidis N. P. and Maldague X. "Quantitative Pulsed Phase Thermography Applied to Steel Plates," *Proc. SPIE - The International Society for Optical Engineering, Thermosense XXVII*, **5782**:342-351, Orlando, FL, 2005.
- [15] Ibarra-Castanedo C., González D. A. and Maldague X. "Automatic Algorithm for Quantitative Pulsed Phase Thermography Calculations," *CD of Proceedings 16<sup>th</sup> WCNDT - World Conference on Nondestructive Testing*, Montreal (Quebec), August 30 - September 3, 2004. *20 min. oral presentation*
- [16] Avdelidis N. P., Ibarra-Castanedo C., Maldague X., Almond D. P. and Moropoulou A. "Thermal NDT&E of Composite Aircraft Repairs," *CD of Proceedings 16<sup>th</sup> WCNDT - World Conference on Nondestructive Testing*, Montreal (Quebec), August 30 - September 3, 2004.
- [17] González D. A., Ibarra-Castanedo C. Maldague X., Madruga F. J. and Lopez-Higuera J. M. "Quantitative Characteristics of Subsurface Defects using an Automated Absolute Contrast Method," *Proc. ODI-MAP IV*, Oulu, Finland, June 16-18 2004.
- [18] Ibarra-Castanedo C. and Maldague X. "Pulsed Phase Thermography Reviewed," *Proc. QIRT 7 – Quantitative Infrared Thermography*, Rhode-Saint-Genèse, Belgium, July 5-8, 2004. *poster*
- [19] González D. A., Ibarra-Castanedo C., Pilla M., Klein M., López-Higuera J. M. and Maldague X. "Automatic Interpolated Differentiated Absolute Contrast Algorithm for the Analysis of Pulsed Thermographic Sequence," *Proc. QIRT 7 – Quantitative Infrared Thermography*, Rhode-Saint-Genèse, Belgium, July 5-8, 2004.
- [20] Ibarra-Castanedo C. and Maldague X. "Traitement numérique de données thermiques par thermographie de phase pulsée quantitative pour l'évaluation non-destructive des matériaux," *Proc. CCECE-Canadian Conference on Electrical and Computer Engineering*, Volume 3, Canadian Conference on Electrical and Computer Engineering; Technology Driving Innovation, p 1757-1760. Niagara Falls (Ontario), May 2-5, 2004. *poster in French (56 x 42 in)*
- [21] Ibarra-Castanedo C. and Maldague X. "Defect Depth Retrieval from Pulsed Phase Thermographic Data on Plexiglas and Aluminum Samples," *Proc. SPIE - The International Society for Optical Engineering, Thermosense XXVI*, **5405**:348-355, 2004. *25 min. oral presentation*
- [22] Avdelidis N. P., Almond D. P., Dobbins A., Hawtin B., Ibarra-Castanedo C. and Maldague X. "Thermal Transient Thermographic NDT & E of Composites," *Proc. SPIE - The International Society for Optical Engineering, Thermosense XXVI*, **5405**:403-413, 2004.
- [23] Torresan H., Turgeon B., Ibarra-Castanedo C., Hébert P. and Maldague X. "Advanced Surveillance Systems: Combining Video and Thermal Imagery for Pedestrian Detection," *Proc. SPIE - The International Society for Optical Engineering, Thermosense XXVI*, **5405**:506-515, 2004.
- [24] Ibarra-Castanedo C., Galmiche F., Darabi A., Pilla M., Klein M., Ziadi A., Vallerand S., Pelletier J.-F. and Maldague X. "Thermographic nondestructive evaluation: overview of recent progress," *Proc. SPIE - The International Society for Optical Engineering, Thermosense XXV*, **5073**:450-459, 2003. *poster (51 x 42 in)*
- [25] Maldague X., Galmiche F., Ibarra-Castanedo C. and Ziadi A. "Review of Pulse Phase Thermography," *TPP 2002 PK-Opto SEP*, November 2002, p 67-73.
- [26] Rouse D. R., Lapointe C., Ibarra-Castanedo C. and Jacquet P. "A Heated Thermistor Air Velocity Sensor," *Proc. ASME-IMECE Heat Transfer. Paper no. 21912*, New York, 2001.
- [27] Ibarra-Castanedo C. and Rouse D. R. "Thermal Characterization of a Multitube Heat Exchanger with Phase Change," *Proc. 4<sup>e</sup> Colloque Interuniversitaire Franco-Québécois de Thermique*, Montréal (Quebec) Canada, 1999, p 65-70. *30 minutes oral presentation in French*

### **Refereed Conference Abstracts**

- [28] Ibarra-Castanedo C., Galmiche F. and Maldague X. "Synthetic Data in Infrared Thermography for NonDestructive Evaluation," *Proc. Annual Congress of the Canadian Association of Physicists (CAP)*, Quebec City (Quebec) Canada, June 2-5, 2002, p 88. *30 minutes oral presentation*
- [29] Ibarra-Castanedo C. and Rouse D. R. "Experimental Thermal Characterization of a Counterflow Heat Exchanger with Phase Change," *Proc. 17<sup>e</sup> Canadian Congress of Applied Mechanics (CANCAM 1999)*, Hamilton (Ontario) Canada, May 30-June 3, 1999, p 281-283. *25 minutes oral presentation*

### **Research Reports**

- Ibarra-Castanedo C., Rivet-Sabourin G., Fournials R. and Maldague X. M. "Exploitation dans les bandes visible et infrarouge des données spectrales du maïs en serre à différents niveaux de stress azoté et de stress hydrique," *Faculté de Foresterie et de Géomatique, Laval University*, 53 p, May 2002. *in French*
- Ibarra-Castanedo C. and Desobry S. "Étude des interactions contenant-contenu pour la conservation des barres chocolatées et des biscuits secs," *Final Report Ahlstrom Paper Group*, Pont-Evêque, France, 22 p, July 2001. *in French*
- Ibarra-Castanedo C. and Desobry S. "Rapport d'étude préliminaire sur la modélisation d'un indice qualité pour pommes et pêches," *Final Report CTIFL*, Paris, France, 38 p, July 2001. *in French*
- Martin D., Rouse D., Thériault R., Boily R., Boudreault J., Leveillé F., Lemay G., Ibarra-Castanedo C. and Poire P. "Optimisation et essai d'un échangeur de chaleur conçu pour la déshumidification des serres," *Final Report CIDES*, Saint-Hyacinthe (QC) Canada, 41 p, February 1999. *in French*

Keywords: image analysis, signal processing, nondestructive evaluation, infrared thermography, multivariate statistical analysis, heat transfer, thermodynamics.