I) Numerical Work:–
• Liquid flow in vibration suppressor tanks (tuned liquid dampers).
• Marangoni convection and slag-line erosion in steel making operations.
• Flow in complex enclosures and ribbed channels (electronic cooling applications).
• Complex flows in automotive torque converters.
• Heat transfer in heat treat operations using inverse conduction analysis.

2) Experimental Work:–
• Optimization of thermal processing operations using statistical modeling methods (e.g., Artificial Neural Networks).
• Development of predictive tools for the heat treatment of metal parts.
• Gas and Liquid jet quenching (rapid cooling).
• Optimization of grind hardening operations.

McMaster Steel Research Center

General Motors Corp.

Members of McMaster Heat Treating Consortium:–
1. NITREX Metal Treating
2. VAC AERO International
3. ABERFOYLE Heat Treaters
4. EXACTATHERM Ltd.
5. A & M Heat Treating
6. INDUSTRIAL HEATING
7. METEX Heat Treating
8. H & S Heat Treating

Niagara Machine Products Inc.

LANXESS Inc., Sarnia, ON

GERDAU AMERISTEEL, Whitby, ON.

Beltech Engineering
**RESEARCH INTERESTS**

Both Experimental and Computational investigations incorporating fundamental and applied research in the field of Thermal Engineering.

**GENERAL AREAS OF INTEREST**

- Computational Fluid Dynamics (CFD) and Heat Transfer.
- Prediction of Microstructure, Internal Stresses, and Distortion during Heat Treating operations.
- Development of Algorithms for moving and free boundary problems.
- Boiling heat transfer associated with liquid jet impingement cooling.
- Convection heat transfer in complex enclosures.
- Gas and liquid jet cooling.
- The use of Artificial Neural Networks in optimization of thermal processing operations.

**THERMAL PROCESSING LABORATORY**

**MISSION**

The development of research projects in co-operation with industrial partners and funding agencies with emphasis upon needs and opportunities in the Canadian market.

**MAIN OBJECTIVES**

- Offer R&D facilities, expertise, and technology for the thermal processing industry.
- Commit to developing and investigating the best solutions for Canadian industry.
- Assist industrial partners to solve immediate problems and help develop long-term R&D strategies.
- Join industry and academia together to find innovative, adaptive, and cost-effective solutions for industrial problems.

**FACILITIES AND RESOURCES**

**MULTI-PURPOSE FURNACE**

A multi-purpose furnace suitable for a wide range of heat treating operations, featuring: temperature rating= 400-1750 °F (200-955 °C), direct and indirect firing systems, with and without protective atmospheres, large working area 72 (w) x 72 (l) x 36(h) inches, with and without air recirculation and temperature uniformity of ±10 °C.

**QUENCH SYSTEMS**

- Liquid quenching both spray and immersion quench capabilities.
- High –Velocity air quench system.
- Spray quench system using multiple jets with different nozzle sizes and a wide range of jet velocity.

**COMPUTATIONAL SOFTWARE PACKAGES**

- ANSYS-CFX™
- DEFORM 3D™ and DEFORM-HT™ (Heat Treat).
- ANNS PREDICTOR™ and SIMCA™.