Research Statement

Future Research Interests and Goals

Through this position I wish I could be able to fulfill the following goals:

- Keep involved in research works related to fluid power and motion control.
- Expand the use of the intelligent digital controllers for the sake of generalized performance and improved dynamics of fluid power and motion control components and systems.
- Build PC-controlled multipurpose and smart hydraulic power supply for the use of research works and standard test protocols.
- Serving the local industries with innovative solutions through collaborative research programs.
- I have a number of patentable ideas that would be of interest to pump and servo valves manufacturers. These ideas y are potential research subjects for graduate students.

Recent and Current Research Activities

- I am currently supervising master of thesis for a student from overseas. His project subject is to develop a reference model for systematic and interactive design procedure for position-controlled hydraulic cylinder.

- I'm currently member of the National Science Foundation Engineering Research Center ERC, "Compact and Efficient Fluid Power Engineering Research Center". My responsibility is to transfer the technology and the research outcomes of the center to the industry professional. http://www.ccefp.org/contact-us/. Through the center I have designed and developed a transportable Universal Fluid Power Trainer. http://www.ccefp.org/education-outreach/industry/transportable-laboratory

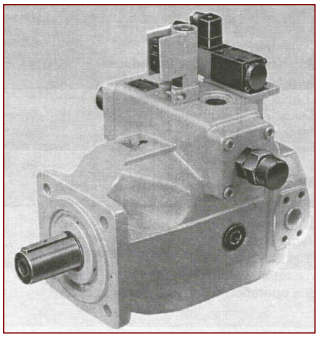
- I'm currently the chief engineer of a project aiming to develop a special hydraulic safety valve to protect the hydraulic systems against catastrophic failure due to line break. http://www.locosafetyvalve.com/howitworks.html

- I have special interest in developing Interactive Engineering Simulations and virtual labs. I had initiated this activity on my personal website. http://www.compudraulic.com/index.htm

Previous Research Experience

- **Ph.D. Project:** project title "*Performance Investigation of Swash Plate Axial Piston Pumps with Conical Cylinder Blocks*". The study started with comprehensive mathematical modeling of an electro-hydraulic servo-actuated variable-displacement swash plate axial piston pump. The developed model has been utilized in studying the torques acting on both the swash plate and the driving shaft bearing due to the piston forces. A comparative study has been conducted to analyze the pump performance in view of different control schemes. First proposed control scheme was to replace the swash plate PD controller currently used in the industry by a fuzzy logic controller in order to improve the control robustness. In the second control scheme, a single negative feedback control loop is proposed to replace the double feedback control loop counting on the good open loop characteristics of the servo-valve that actuating the pump swash plate. The developed model and the simulation findings have been verified experimentally. Through this project, I gained hands-on experience in using modeling, simulation and real time control various techniques.

- **Master of Engineering Project:** Through my M.Sc. study, I carried out a theoretical investigation followed by an experimental verification for the static characteristics of a Four Nozzle-Pintle Hydraulic Servo-Valve.



- **Paper Publication:** I had published some distinguished journal refereed papers. Some other papers presented in proceedings of several international conferences. Lately I paid more attention to publish in the field of engineering education area. Please refer to my list of publications.

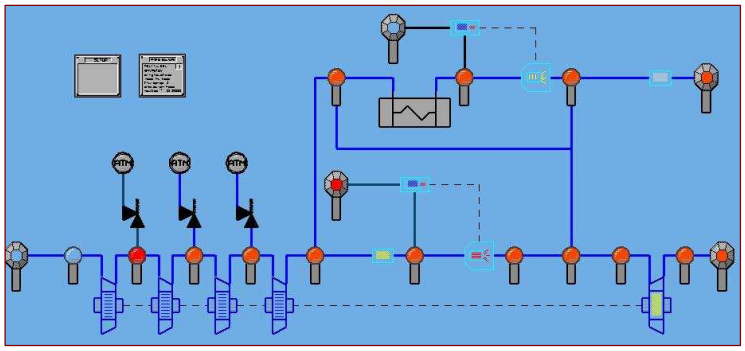
- **Undergraduate Students Supervision:** During my PhD study, I have been assigned to supervise undergraduate student's course projects in the field of fluid power control. The project was to develop fluid power toolbox mathematical models to be used in system-level simulation in Matlab-Simulink environment.

- **Graduate Students Supervision:** Near the end of my PhD project, in view of my responsibility as a research assistant, I was in charge of supervising a project of a graduate student towards his mater degree. The project was to develop a hydraulic control system for controlling the rolling mill operating conditions using variable displacement pump and electro-hydraulic pressure compensator.

- **Technical Reports:** In view of the collaboration of Concordia University Aerospace Program with the local industries, I was requested to write a technical report about hydraulic pump cavitation for Bombardier Aerospace, Montreal, Canada.

- **Power Plant Modeling and Simulation:** In my work as a simulation software developer for CAE Inc., Montreal, Canada. I was responsible for development, testing and integrating of comprehensive mathematical models of Combined Cycles Gas Turbines and Fluid Power control systems and components. The developed models are used as reference models in power plants full-scale simulators and real time control systems.

- Examples of the developed models are as follows: Turbine, compressors, steam injectors, fuel injectors, combustion chambers, positive displacement pumps (fixed and variables), hydraulic control valves (pressure, directional and flow), hydraulic actuators (cylinders and motors), accumulators



Research Awards:

- Post Doctoral, Industrial Research Fellow (IRF), 2003, Natural Sciences and Engineering Research Council of Canada, NSERC.
- First prize of the student design paper competition, International Conference on Multidisciplinary Design in Engineering CSME-MDE2001, November 21-22, Concordia University, Montreal, Canada.

Natural Sciences and Engineering Research Council of Canada / Conseil de recherches en sciences naturelles et en génie du Canada

The Natural Sciences and Engineering Research Council of Canada is pleased to congratulate

2002

Le Conseil de recherches en sciences naturelles et en génie du Canada félicite

Medhat Khalil

on success in the competition for an

NSERC Industrial Research Fellowship

de sa réussite au concours de

Bourses de chercheurs-boursiers en milieu industriel du CRSNG

This award recognizes academic excellence, research ability and potential, and leadership and communication skills.

Cette bourse souligne l'excellence du dossier universitaire, les compétences et le potentiel en recherche, les qualités de leadership ainsi que les talents de communicateur du titulaire.

Thomas A. Brzustowski
President / Président

Canada

NSERC CRSNG

The Canadian Society for Mechanical Engineering

La societé canadienne de génie mécanique

CSME Conference on Multidisciplinary Design in Engineering
Concordia University, November 21-22, 2001

Conférence de la SCGM sur la conception multidisciplinaire en ingénierie
Université Concordia, le 21-22 novembre 2001

CSME-MDE 2001

First Prize 2001 Premier Prix

Student Design Paper Competition

Concours de conception pour étudiant(e)s

awarded to **Medhat Kamel Bahr Khalil** décerné à

for/pour

RESPONSE OF CONSTANT POWER REGULATED SWASH PLATE AXIAL PISTON PUMPS TO HARMONIC AND RANDOM INPUTS

Presented at Concordia University
Montreal, Quebec
November 22, 2001

R.B. Bhat
Co-Chair, CSME-MDE 2001

V.N. Latinovic
Chair, Student Competition

Présenté à l'Université Concordia
Montréal, Québec
le 22 novembre 2001