Sohaib A. M. Obeid

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Clarkson University, Department of Mechanical & Aeronautical Engineering, P O BOX 5725; 13699 POTSDAM ; NEW YORK ; USA

EDUCATION

PhD (ABD) Clarkson University, Potsdam; New York, USA

DSc. Student, Lab of vibration and acoustics, University Federal of Santa Catarina, Florianopolis, (2007)

Master Recherche in Fluid Dynamics and Transfer, Université de Paul Sabatier, Toulouse (III), France, (2007)

French Language Certificate, Université de Paul Vallery, Montpellier (III), France

PhD Student, Military College of Engineering Baghdad- Iraq, Feb. 2000 – March 2003, Studies not finished due to the Iraqi crisis and war held there

M.Sc. in Mechanical (Aero) Engineering, University of Addis Abbaba (Ethiopia) + University of Khartoum Sudan 1996

B.Sc. honors in Aeronautical Engineering- Class of award Very Good, Military technical College Cairo - Egypt, 1985

APPOINTMENTS

June 2011-Present **Teaching Assistant**, Clarkson University, MAE Department, Potsdam; New York, USA

2008- Jan 2009 **Research Associate**, Optiwind Project, Clarkson University, MAE Department. Potsdam; New York, USA

Feb-July 2008 **Internship Researcher**, Aero-acoustic Laboratory, KAIST, Korea Advanced Institute of Science and Technology

Jan. - July 2004 **Engineering Consultant**, Unilog Systems Services Co. Limited

Mar. - Dec. 2003 **Lecturer**, Faculty of Engineering, Karrary Academy of Technology

1996 - Feb. 2000 **Lecturer**, Faculty of Engineering, Karrary Academy of Technology

1988 **-** 1991 **Registrar,** Sudan Air force Institute

1987-1988 **Commandant** , Planning and Follow-up department, Sudan Air force Institute

1986 **Licensed Maintenance Engineer**, Fighter (5) Squadron, Wadi Siedna Airbase

1986 **Maintenance Engineer**, Mig (21) Squadron, Wadi Siedna Airbase

July 1985 **First Lieutenant Eng**, Wadi Siedna Airbase Omdurman Sudan

1980- July 1985 **Engineering Cadet**, Military Technical College Cairo, Egypt

PROFESSIONAL TRAINING

2005: Training course in Airbus Company, Methods of Noise Generation and Suppressions in Passenger Aero- Planes, Toulouse, France

2004: Training course in Central School of Lyon- Group of Numeric simulations and modeling in aero-acoustics, France

1998: Training course in experimental fluid mechanics and heat transfers, (Subsonic/ Supersonic Wind tunnels), Technical Equipments. U.K

1996: Training course in NDI (none destructive inspections) techniques used in field of aero-space engineering, Azza Air Transport Company & KLM Khartoum

1995: Training course in different modules of static/ dynamic balancing of engine rotating parts: PT6, JT3D, JT8D, JT9D & PW 2000, Engine Shop, Ethiopian Airlines, Addis Ababa

1994: Training course in Testing and Inspection of Gas Turbine Engines, Training Center, Ethiopian Airlines, Addis Ababa

1986: Conversion course in Chinese aircraft Fighter (5), Sudan Air force Training Institute. Khartoum- Sudan

1985: Conversion course in maintenance and servicing of the military jet fighter Mig (21), Sudan Air force Training Institute. Khartoum- Sudan.

ACADEMIC ACHIEVMENTS

Research: Structural analysis of wind turbine blades, Structural analysis of A/C structures, Turbo-machinery blades, Aero-acoustics of rotating units (external flows and internal flows), Dynamic modeling of structures, conceptual design studies of turbojet engines, including thrust to weight ratio, estimation of equilibrium run line, noise reduction, thrust vectoring and performance calculation, Design of Ram/Scramjet Engines, Design of Rocket Motors, Reduced order modeling of fluid flows, CFD RANS modeling, Design of Control Algorithms.

Teaching: Diploma course for aeronautical technicians (Engineering Drawing,

Mathematics, Fluid Mechanics, Theory of Flight, Airframe Design, Jet Engine Design, Airworthiness Requirements, Air Engineering Services) , License course for aeronautical engineers, technician engineers, and technicians, (Aerodynamics, Thermodynamics, Design of Aircraft Engines), Basic Trade Courses, License course for aeronautical technicians, (Auxiliary Trade Courses), Pilot's ground school courses. (Long & Short Term Courses), Under graduate engineering courses (Both Aeronautical & Mechanical), teaching aerodynamics, theory and design of aero-engines, combustion, fluid mechanics, Different phenomena associated with fluid/solid interactions, Control theory and control designs, Stochastic problems in engineering applications, Pattern classifications and Neural net work analysis based controls

Service: Member of SAFI Curriculum Committee (1988-1994) which set and reviewed the institute curriculum through the academic link-up program between the institute and South-East Wales Polytechnic, Executive Member in the establishment of Sudan Air force College, Piloting Section in Port Sudan, The Organizer, Coordinator, and Lecturer in Many courses held by SAFI, Member of the SAFI Institute Academic Board, Member of Karrary Academy of Technology, Faculty of Engineering Curriculum Development Committee, Supervisor of fluid mechanics lab of Faculty of Engineering of Karrary Academy of Technology, The Supervisor of the projects of the School of Aeronautics in the College of Aviation Sciences. Khartoum-Sudan, Participant in the project of Khartoum Aerospace and Technology Academy

MISCELLANEOUS

Languages**:** English (Fluent written and spoken), French (Fluent written and spoken), Arabic (Fluent written and spoken), Hebrew (Poor written and considerable spoken), Portugúes (considerable written and poor spoken)

Considerable experience in: Utilization of the Codes: ANSYS-FlUENT, Answers, AutoCAD, Cad, Solid Works, Tec plot, Nastran, Patran, Jadim, MATLAB, Sigma Plot.

Understanding of: Basic, FORTRAN 77, FORTRAN 90, Visual Basic, Visual FORTRAN, C, C++, Computer Programming with: Basic, FORTRAN 77, FORTRAN 90, Visual Basic, and Visual FORTRAN

AWARDS AND HONORS

1) Student Member – Engineers without Borders ewb-usa.org,
2) Student Member – American Society of Mechanical Engineers ASME, http://www.asme.org
3) Student Member- Society of Industrial and Applied Mathematics SIAM, http://epubs.siam.org
4) Student Member of Japanese Aeronautical Society, JSASS, http://www.jsass.or.jp
5) Member of Engineering and Physical Sciences Committee belongs to Scientific and Editorial Board, World Academy of Science, Engineering and Technology.
6) National Merit Scholarship (Sudan), 1980-1985.

LIST OF PAPERS WRITTEN

More than ten papers

SCIENTIFIC PARTICIPATIONS

More than 50 participations

RESEARCH INTERESTS

1) Analytical, experimental and numerical researches in Aero acoustics (both external and internal flows). This includes also reduced order modeling, design and implementation of control algorithms verification of control laws. Problems of fluid/solid interactions.

2) Analytical, experimental and numerical activities related to fluid flows (steady and unsteady models) in aerospace engineering and fluid machines. Design of air breathing engines such as (Gas turbine engines), (Scramjet/ramjet and pulse engines) in addition to solid and liquid rocket motors.

3) Analytical, experimental and numerical analysis of subsonic combustions and supersonic combustions.

4) Active Control of fluid flows (both internal and external flows) / flow induced vibrations in aerospace structures. Implementation of different control techniques and reduced order modeling linear/ nonlinear dynamic systems.

5) Experimental aerodynamics and wind tunnel activities.

REFEREES

1) Prof. **Goodarz Ahmadi,** Dean, Wallace H. Coulter School of Engineering Mechanical and Aeronautical Engineering, Clarkson University, PO Box 5725,Potsdam, NY 13699-5725, Phone: 315-268-2322, Fax: 315-268-4494,E-mail: ahmadi@clarkson.edu
2) **Ratneshwar (Ratan) Jha,**Associate Professor, Clarkson University PO Box 5725, Potsdam, NY136995725, Phone: 315-268-7686, Fax: 315-268-6695,E-mail: rjha@clarkson.edu

3) Prof. **Ricardo Musafir**, D.ScUniversidade Federal do Rio de Janeiro, Engenharia Mecânica, Tel: (+5521) 2562-8397, email: rem@mecanica.ufrj.br

4) Prof. **Piergiovanni Marzocca**, Ph.D.Assistance Professor – Clarkson University, The Wallace H. Coulter School of Engineering, Mechanical and Aeronautical Engineering Dept.,Camp 234, Potsdam, New York 13699-5725, Tel: 315-268-3875 , fax: 315- 268- 6695, Email: pmarzocc@clarkson.edu

5) Prof. **Serge Lévy**, Directeur de recherche et Chef d´unité à l´ONERA, Office National d´Études et de Recherches Aérospatiales, Tel: (+3301) 46 73 48 13 email: Serge.Lewy@onera.fr

6) Prof. **André Giovannini**,
Universite Paul Sabatier Institut de Mecanique des Fluides de Toulouse,UFR-MIG, Dépt de Mécanique UMR 5502 CNRS/INP-UPS, 118 Route de Narbonne, Avenue du Professeur Camille Soula 31062, Toulouse 31400

Toulouse, Tel:33(0)561556184 Tel:33(0)561285948 Fax:33(0)561558326 Fax:33(0)561285992, E-mail : giova@cict.fr or E-mail : giova@imft.fr

HOBBIES AND INTEREST:

Sports, Fishing, Traveling and Studying.

Numerical Prediction of Supersonic Inviscid and Viscous Flow over Arbitrary Configurations

The main objective of the project work was to develop a solution algorithm based on the control volume finite difference CFD methods, for solving transonic and supersonic aerodynamic problems over a wide range of shapes. It is now will established globally that CFD reduces the efforts for researchers who are interested in this field. The numerical solution reduces the experimental effort, which is highly expensive and needs long time to collect all the data required. The analytical solution is confined or restricted to simple shapes and doses not cover a wide range of the flow field area, (shapes and geometry)..

The current work introduces solutions to supersonic fluid dynamic problems using different numerical techniques. Navier–Stokes equations are solved using time marching (MacCormack) explicit technique, in which Laminar and turbulent supersonic flows were solved. Two-dimensional laminar flow over a flat plate, compression ramp and arc circular bump are tested. For turbulent flow, Baldwin Lomax model was used to approximate the turbulence effect, on the Flat plate and compression ramp. The flow conditions are taken at sea level and Mach number up to 4.0 was tested. In the case of inviscid flow, Euler equations were solved both explicit and implicit techniques. For explicit two MacCormack schemes were used, space and time marching techniques. For implicit splitting vector technique, the Van-Leer time marching was used. All techniques succeeded to solve two dimensional planner and axis-symmetry flows. Two-dimensional and three-dimensional flows range from upstream subsonic to supersonic flow over an arbitrary configurations (double wedge, wedge, NACA (0012), tangent ogive, hemisphere, hemisphere cylinder, and arc circular bump) were solved successfully. The flow conditions are taken at sea level and Mach number was up to 3.5 Body fitted coordinates were used to overcome the shape difficulties. These coordinates are succeeding in solving viscous and inviscid supersonic flow problems. Different techniques are used for generating the meshes, algebraic, elliptic and hyperbolic. The efficient solution algorithm and the selective techniques were successful in capturing the shocks and predicting well the thermal and hydrodynamic boundary layer in laminar and turbulent flow, and treating complex geometries. The results are compared with the published experimental and numerical data and showed good agreement.

REVISITING THE PROBLEM OF SOUND FIELD OF POINT MULTIPOLE SOURCES IN A LINEAR SHEAR LAYER

The problem of propagation of the sound waves emitted from various point sources through a bi-dimensional linear shear layer has been revisited. An analysis has been developed for calculating the far field acoustic pressure for these sound waves. The sound waves are produced from a point source either situated in a uniform flow near the shear layer or in the shear layer itself. Closed-form analytic expressions for the far-field pressure have been obtained for several different types of sources as monopole, dipole and quadrupole.

The analysis is exact for all frequencies and is developed assuming stationary point sound sources situated at a linear velocity profile transverse shear layer. This postulate allows the solution to be expressed in terms of parabolic cylinder functions. Asymptotic expansions for the exact solutions were developed. These Approximate expressions were obtained for limiting cases of high and low frequencies for each type of source.

A MatLab code was constructed so as to assist in comparing the results obtained analytically with those of Scott's approach. Special attention was paid towards the case of quadrupole source in shear layer. This to verify the correct quadrupole solution with the one obtained by Scott, and to which extent the conclusions drawn by Scott's based on his results are correct or should be altered.

Design of Closed-loop Controllers for Active Control of Flow over Flapped Airfoil

The aim of this study is to develop closed-loop feedback control algorithms for turbulent flow separation phenomena over 2-D flapped airfoil equipped with set of synthetic jet actuators (SJAs). The control objective is to delay flow separation or stall by actuating the SJAs through a closed-loop control algorithm using surface pressures as sensor data. Fluent simulation results are validated by wind tunnel test data of turbulent flow over a NACA 0015 airfoil at $Re=1x10^6$. Two approaches to control system design are investigated, namely system identification using NARMAX model and proper orthogonal decomposition (POD) technique. A NARMAX model of the flow is constructed using data from a pressure sensor which includes nonlinearities in the flow excited by synthetic jets. A synthetic jet actuator model is employed and controller design follows the standard PI algorithm for single-input single-output system. The response of the resulting closed loop feedback control system (comprised of PI controller, SJA model and NARMAX model) is shown to track the desired pressure command. A significant improvement in the transient response over the open-loop system at high angles of attack is realized. The second control algorithm uses stochastic estimation technique and proper orthogonal decomposition for multiple surface pressure sensor measurements. Real-time instantaneous low-dimensional estimates of the pressure field over the airfoil are computed from the unsteady surface pressure. These estimates provide direct information about the flow state over the airfoil. As a result of this low-dimensional modeling approach, the first static pressure-based POD coefficient is chosen as control variable. It is shown that POD based proportional and proportional-integral multiple-input single-output feedback control delays flow separation at high angles of attack (above 16 degrees). The benefits of closed-loop control versus open-loop control are thoroughly investigated. Parametric studies for the effect of velocity profile configuration of synthetic jets on airfoil aerodynamic performance parameters, and effect of synthetic jets frequency upon stability and robustness of the proposed controller will be included in the final dissertation. The control design methods reported in this work will be used for wind tunnel testing in future.

Sohaib Obeid

Field of Study

I studied Aerospace Engineering in BSc, MSc and PhD levels. I am capable to design, repair and maintain all flying objects such as aero-planes, rockets, missiles, wind mills, aero-engines and all aeronautical (space-related) objects to the best of knowledge.

To get my basic degree (BSc) in this field, I designed successfully a multi stage axial flow compressor used as a part of a Jet Engine. This designed engine was inspected experimentally in model scale and provided significant results.

I have two (MSc) degrees. In the first dissertation, I designed successfully an aero- engine inspection rig from the available resources (Mainly the Air forces discarded items and scrap). I did all the mechanical works and built the rig from scratch. This rig was used to inspect an actual existing aircraft engines for a while and then destroyed by the new owner of place. The rig also was used for educational purposes in the Institute to which I was working.

In the second MSc dissertation, I made some corrections in analytical aero-acoustics formulae (Lilley's Equation). This correction was found useful and opened the door for many researchers to revisit the topic and study the equation again.

In my first PhD which is not finished in Iraq, I designed a Scramjet Engine to operate at Mach number 3. This design consists of aero-thermal analysis using self written computational codes besides structural analysis of the various components using Finite Element Methods. I also rehabilitated the aero-engines laboratory which belongs to the Iraqi military engineering college. I returned two test cells to operation and I built a test rig for inspecting both Pulse Engines and Ram Engines.

In my current studies of PhD, I implemented new techniques of reduced order modeling for the air flow patterns over airfoils and wings and I designed successfully a closed loop feedback controller to control the airflow separation phenomena over the airfoils and wings based on that reduced order technique. Most of the work was done using numerical simulations and part of it validated doing wind tunnel experiments.

Unique Contributions in the Field

1. Contributing in establishment of many aerospace institutions in Sudan.
2. Designing of two engine test rigs, one used for inspecting Jet Engines and the other for inspecting Pulse and Ram Engines.
3. Developing educational programs in aerospace engineering institutions in Sudan and also in Sultanate of Oman.
4. Developing and implementing new techniques in scientific fields to improve the performance of existing objects.
5. Making use out of all the available resources.