Second Summer Camp of
the APSCO Student Small Satellite
(SSS) Project

Handbook

Ankara, Turkey

July 30 – August 17, 2018

Contents

Welcome

Welcome to the Department of Aerospace Engineering, an internationally recognized aerospace engineering school in Turkey.

Founded in 1981, METU Department of Aerospace Engineering has been playing a key role in the development of the Turkish aerospace industry as well as aerospace research. Our nearly 2000 graduates, have taken pioneering jobs in many high technology aerospace projects in Turkey. A number of our graduates were from other countries, have also been acting as pioneers in the development of aerospace technologies in their home countries.

We are happy to see many of our graduates find positions in top universities and research centers as well as in well-known international companies, in Europe and America.

Aerospace engineering education and research have been evolving continuously since the Second World War. In recent decades, we have also witnessed many advances in this area. Amongst them, multidisciplinary design optimization of aerospace vehicles, utilization of composite materials, smart and morphing aerospace structures, unmanned air vehicles with increased autonomy, new launch vehicles for space tourism, and space vehicles with solar sail and/or electric propulsion may be mentioned. The state of the technology is also shaped by environmental considerations. Amongst them, green aerospace technologies are attracting more and more interest such as hybrid or all electric aircraft propulsion, better scheduling of aircraft traffic to reduce pollution, or development of spacecraft to collect space debris, may be mentioned.

We will continue to pursue excellence in education and research with our state-of the art facilities and outstanding faculty. We constantly monitor the trends and developments in the aerospace sciences and technology, and will be hiring new faculty, with research goals in the currently developing areas of the field.

Once more welcome to our department. I hope the next three weeks in METU will be an enjoyable and memorable time period for you.

Prof. Dr. Ozan Tekinalp

Introduction

Asia-Pacific Space Cooperation Organization (APSCO) has initiated the Student Small Satellite (SSS) project, which is aimed to train the students and faculties from Member States (MSs) of APSCO to study space technology and satellite engineering through practical design of satellites until the flight model is made, and meanwhile contribute to the development of space education systems in APSCO MSs. The ultimate goal of this project is not only to enable universities to undertake student satellite design and development, but also to impart space technologies through a satellite project as well as hands-on training. Therefore, one of the most important and special aspects of the project is training/education. This Summer Camp is just an important activity of training/education.

The training/education of the SSS project contains short-term trainings and long-term trainings. It has planned to arrange 3 times of the short-team trainings that are Summer Camps of small satellite technologies in the 3 summers of year 2017, 2018 and 2019. This is the Second Summer Camp of SSS project.

The Second Summer Camp of the APSCO SSS Project is arranged at Middle East Technical University during 30th July to 17th August, 2018, as a part of the training program of the SSS project. This training will concentrate manily on the test and integration of satellites.

Lecturers from China and Iran will take part in the program. There are also a number of lecturers from METU (Middle East Technical Univesity) and TUBİTAK-UZAY (Space Techologies and Research Institude of the Scientific and Technological Research Council of Turkey) . Laboratories and demonstations will also be carried out at the facilities of the Aerospace Engineering Department of METU, TUBİTAK-UZAY, and TAEK (Turkish Atomic Energy Authority).

Organizers

Organized by:

Asia-Pacific Space Cooperation Organization（APSCO）

Hosted by :

Middle East Technical University

Organizing Committee :

Chairperson:

Prof. Dr. Ozan Tekinalp	Department Chair of Aerospace Engineering of Middle East Technical University

Vice- Chairpersons:

Dr. Mohammad Ebrahimi Seyedabadi	Director General of Department of Education and Training and Database Management of APSCO
Dr. Erdal Yılmaz	Deputy Director of TÜBİTAK-UZAY

Members :

Ms. Stacey Zhao

Ms. Jessica Zhuang

Mr. Aziz Koru

Ms. Nilgün Kaplan

Teaching Assistants :

Mr. Abdurrahim Muratoğlu

Mr. Ali Tevfik Büyükkoçak

Mr. Süleyman Altınışık

Mr. Ahmet Arda Akay

Mr. Oğuz Atalay

Mr. Harun Levent Şahin

Mr. Ömer Ataş

Mr. Çağlar Seylan

Mr. Alperen Eroğlu

Ms. Pelin Uslu

Mr. Hasan Bellikli

Mr. Süleyman Köse

Mr. Hilmi Berk Gür

Venue：

Middle East Technical University, Ankara, Turkey

Program

Date	Time	Contents	Venue
July 29th (Sunday)	12:00-24:00	Registration	Guest Houses
The First Week			
July 30th (Monday)	08:30-09:00	Registration	Aerospace Engineering Department
	09:00-09:15	Welcome speech addressed by TÜBİTAK UZAY	
	09:15-09:30	Speech addressed by Dr. M. Ebrahimi Seyedabadi	
	09:30-09:45	Speech addressed by Prof. Dr. Ozan Tekinalp, METU	
	09:45-10:00	Speech addressed by Prof. Dr. Huang Haijun, BUAA	
	10:00-10:30	Group Photo	
	10:30-11:00	Tea Break	
	11:00-11:30	Speech by representatives of Member States	
	11:30-12:00	Introduction of 2nd Summer Camp, METU and Ankara	
	12:00-14:00	Lunch	METU
	14:00-15:30	Turkish Team presentation of SSS-2B	Aerospace Engineering Department
	15:30-17:00	Tea Break	
	16:00-17:30	Turkish Team presentation of SSS-2B Questions and Answers	
July 31st (Tuesday)	09:00-10:30	Finite Element Modeling Lecture (Assoc. Prof. Dr. Ercan Gürses, METU)	Aerospace Engineering Department
	10:30-11:00	Tea Break	
	11:00-12:30	Finite Element Modeling Lecture (Assoc. Prof. Dr. Ercan Gürses, METU)	
	12:30-14:00	Lunch Break	
	14:00-15:30	Launch and Space Environment Lecture (Dr. Cevher Levent Ertürk, TÜBİTAK UZAY)	
	15:30-16:00	Tea Break	
	16:00-17:30	Launch and Space Environment Lecture (Dr. Cevher Levent Ertürk, TÜBİTAK UZAY)	
Aug 1st (Wednesday)	09:00-10:30	Finite Element Modeling Lab (Assoc. Prof. Dr. Ercan Gürses, METU)	Aerospace Engineering Department
	10:30-11:00	Tea Break	
	11:00-12:30	Finite Element Modeling Lab (Assoc. Prof. Dr. Ercan Gürses, METU)	
	12:30-14:00	Lunch Break	
	14:00-15:30	Finite Element Modeling Lab (Assoc. Prof. Dr. Ercan Gürses, METU)	

Date	Time	Contents	Venue
	15:30-16:00	Tea Break	
	16:00-17:30	Finite Element Modeling Lab (Assoc. Prof. Dr. Ercan Gürses, METU)	
Aug 2nd (Thursday)	09:00-10:30	Experimental Modal Analysis Lecture (Assoc. Prof. Dr. Melin Şahin, METU)	Aerospace Engineering Department
	10:30-11:00	Tea Break	
	11:00-12:30	Experimental Modal Analysis Lecture (Assoc. Prof. Dr. Melin Şahin, METU)	
	12.30-14.00	Lunch Break	
	14:00-15:30	Experimental Modal Analysis Lab (Assoc. Prof. Dr. Melin Şahin, METU)	
	15:30-16:00	Tea Break	
	16:00-17:30	Experimental Modal Analysis Lab (Assoc. Prof. Dr. Melin Şahin, METU)	
Aug 3rd (Friday)	09:00-10:30	Experimental Modal Analysis Lab (Assoc. Prof. Dr. Melin Şahin, METU)	Aerospace Engineering Department
	10:30-11:00	Tea Break	
	11:00-12:30	Experimental Modal Analysis Lab (Assoc. Prof. Dr. Melin Şahin, METU)	
	12:30-14:00	Lunch Break	
	14:00-15:30	Experimental Modal Analysis Lab (Assoc. Prof. Dr. Melin Şahin, METU)	
	15:30-16:00	Tea Break	
	16:00-17:30	Experimental Modal Analysis Lab (Assoc. Prof. Dr. Melin Şahin, METU)	
Aug 4th (Saturday)	08:30-12:30	Technical Visit (TUSAŞ Aerospace Industries, Satellite Test and Integration Labs)	Turkish Aerospace Industries (TAI)
Aug 5th (Sunday)		Day-off	
The Second Week			
Aug 6th (Monday)	09:00-10:30	Embedded Systems Lecture (Assoc. Prof. Dr. Uluç Saranlı, METU)	Aerospace Engineering Department
	10:30-11:00	Tea Break	
	11:00-12:30	Embedded Systems Lecture (Assoc. Prof. Dr. Uluç Saranlı, METU)	
	12:30-14:00	Lunch Break	
	14:00-15:30	Embedded Systems Lab (Assoc. Prof. Dr. Uluç Saranlı, METU)	
	15:30-16:00	Tea Break	
	16:00-17:30	Embedded Systems Lab (Assoc. Prof. Dr. Uluç Saranlı, METU)	

Date	Time	Contents	Venue
Aug 7th (Tuesday)	09:00-10:30	Embedded Systems Lecture (Assoc. Prof. Dr. Uluç Saranlı, METU)	Aerospace Engineering Department
	10:30-11:00	Tea Break	
	11:00-12:30	Embedded Systems Lecture (Assoc. Prof. Dr. Uluç Saranlı, METU)	
	12:30-14:00	Lunch Break	
	14:00-15:30	Embedded Systems Lab (Assoc. Prof. Dr. Uluç Saranlı, METU)	
	15:30-16:00	Tea Break	
	16:00-17:30	Embedded Systems Lab (Assoc. Prof. Dr. Uluç Saranlı, METU)	
Aug 8th (Wednesday)	09:00-10:30	Assembly Integration and Test Lecture (Mr. Xiaofeng ZENG, Changguang Sat. Tech. Co.)	Aerospace Engineering Department
	10:30-11:00	Tea Break	
	11:00-12:30	Assembly Integration and Test Lecture (Mr. Xiaofeng ZENG, Changguang Sat. Tech. Co.)	
	12:00-14:00	Lunch Break	
	14:00-15:30	Assembly Integration and Test Lecture (Mr. Xiaofeng ZENG, Changguang Sat. Tech. Co.)	
	15:30-16:00	Tea Break	
	16:00-17:30	Assembly Integration and Test Lecture (Mr. Xiaofeng ZENG, Changguang Sat. Tech. Co.)	
Aug 9th (Thursday)	09:00-10:30	Cummunication System Testing Lecture (Dr. Volkan Akan & Dr. Raşit Tutgun, TÜBİTAK UZAY)	Aerospace Engineering Department
	10:30-11:00	Tea Break	
	11:00-12:30	Cummunication System Testing Lecture (Dr. Volkan Akan & Dr. Raşit Tutgun, TÜBİTAK UZAY)	
	12:00-14:00	Lunch Break	
	14:00-15:30	Cummunication System Testing Demonstration (Dr. Volkan Akan & Dr. Raşit Tutgun, TÜBİTAK UZAY)	
	15:30-16:00	Tea Break	TÜBİTAK UZAY
	16:00-17:30	Cummunication System Testing Demonstration (Dr. Volkan Akan & Dr. Raşit Tutgun, TÜBİTAK UZAY)	
Aug 10th (Friday)	09:00-10:30	Space Environment and Radiation Testing Lecture (Prof. Dr. Bilge Demirköz, METU)	Aerospace Engineering Department
	10:30-11:00	Tea Break	
	11:00-12:30	Space Environment and Radiation Testing Lecture (Prof. Dr. Bilge Demirköz, METU)	
	12:30-14:00	Lunch Break	

Date	Time	Contents	Venue
	14:00-15:30	Space Environment and Radiation Testing Demonstration (Prof. Dr. Bilge Demirköz, METU)	TAEK
	15:30-16:00	Tea Break	
	16:00-17:30	Space Environment and Radiation Testing Lecture (Prof. Dr. Bilge Demirköz, METU)	
Aug 11th (Saturday)	09:00-17:30	Cultural Visiting	Ankara
Aug 12th (Sunday)		Day-off	
The Third Week			
Aug 13th (Monday)	09:00-10:30	Attitude Control Lecture (Assoc. Prof. Dr. Mehran Mirshams, KNTU)	Aerospace Engineering Department
	10:30-11:00	Tea Break	
	11:00-12:30	Attitude Control Lecture (Assoc. Prof. Dr. Mehran Mirshams, KNTU)	
	12:30-14:00	Lunch Break	
	14:00-15:30	Attitude Control Lecture (Assoc. Prof. Dr. Mehran Mirshams, KNTU)	
	15:30-16:00	Tea Break	
	16:00-17:30	Attitude Control Lecture (Assoc. Prof. Dr. Mehran Mirshams, KNTU)	
Aug 14th (Tuesday)	09:00-10:30	Attitude Control Lab (Assoc. Prof. Dr. Mehran Mirshams, KNTU)	Aerospace Engineering Department
	10:30-11:00	Tea Break	
	11:00-12:30	Attitude Control Lab (Assoc. Prof. Dr. Mehran Mirshams, KNTU)	
	12:30-14:00	Lunch Break	
	14:00-15:30	Attitude Control Lab (Assoc. Prof. Dr. Mehran Mirshams, KNTU)	
	15:30-16:00	Tea Break	
	16:00-17:30	Attitude Control Lab (Assoc. Prof. Dr. Mehran Mirshams, KNTU)	
Aug 15th (Wednesday)	09:00-10:30	Satellite Attitude Determination Lecture (Dr. Ersin Söken, Turkey)	Aerospace Engineering Department
	10:30-11:00	Tea Break	
	11:00-12:30	Satellite Attitude Determination Lecture (Dr. Ersin Söken, Turkey)	
	12:30-14:00	Lunch Break	
	14:00-15:30	Power System Lecture (Mr. Barış Çolak, TÜBİTAK UZAY)	
	15:30-16:00	Tea Break	
	16:00-17:30	Power System Lecture (Mr. Barış Çolak, TÜBİTAK UZAY)	

Date	Time	Contents	Venue
Aug 16th (Thursday)	09:00-10:30	Power System Testing (Mr. Barış Çolak, TÜBİTAK UZAY)	TÜBİTAK UZAY
	10:30-11:00	Tea Break	
	11:00-12:30	Power System Testing (Mr. Barış Çolak, TÜBİTAK UZAY)	
	12:30-14:00	Lunch Break	
	14:00-15:30	Thermal Cycle Lecture (Mr. Mustafa Türkmenoğlu, TÜBİTAK UZAY)	Aerospace Engineering Department
	15:30-16:00	Tea Break	
	16:00-17:30	Thermal Cycle Lecture (Mr. Mustafa Türkmenoğlu, TÜBİTAK UZAY)	
Aug 17th (Friday)	09:00-10:30	Thermal Cycle Testing Demonstration (Mr. Mustafa Türkmenoğlu, TÜBİTAK UZAY)	TÜBİTAK UZAY
	10:30-11:00	Tea Break	
	11:00-12:30	Thermal Cycle Testing Demonstration (Mr. Mustafa Türkmenoğlu, TÜBİTAK UZAY)	
	12:30-14:00	Lunch Break	
	14:00-17:00	Closing Ceremony	Aerospace Engineering Department
Aug 18th (Saturday)		Departure	

Lecturers

Assoc. Prof. Dr. Ercan Gürses

Dr. Gürses received his B.Sc. degree in Civil Engineering from the Middle East Technical University, Ankara, Turkey in 1999 and M.Sc. degree from Computational Mechanics of Materials and Structures (COMMAS) program of University of Stuttgart, Germany in 2002. He later received his Ph.D. degree in Civil Engineering from University of Stuttgart, Germany in 2007. He then joined Graduate Aerospace Laboratories (GALCIT) of California Institute of Technology as a postdoctoral fellow until 2009. He then served as a postdoctoral researcher in Mechanical Engineering Department of King Abdullah University of Science and Technology (KAUST), Saudi Arabia between 2009 and 2011. In 2011, he joined the Middle East Technical University, Ankara, Turkey, where he is currently an Associate Professor in the Department of Aerospace Engineering.

His research interests include theoretical and computational mechanics of solids, multiscale material modeling, composite modeling, nanocomposites, morphing structures and computational modeling of aerospace structures.

Lecture: Introduction to Finite Element Method

The purpose of the lecture is to give a short introduction about Finite Element Method (FEM). The fundamental steps of FEM will be discussed. The lecture, in particular, will focus on structural mechanics and vibration related problems. In the lecture, some example problems will be solved by using the commercial FEM package ANSYS.

Dr. Cevher Levent Ertürk

C. Levent Ertürk has received his B.Sc. degree (1993) and M.Sc. degree (1996) from Aeronautical Engineering Department of Middle East Technical University. After a year's break for an OJT program at Georgia Tech and Sikorsky Aircraft, he has completed his Ph.D. thesis on active control of vibration in the same department at METU. Since 2000, he has been working at TUBİTAK-UZAY and participated in earth observation satellite development projects, namely, BILSAT, a joint project between UZAY and SSTL (Surrey Space Technology Ltd.), RASAT, first indigenous Micro Satellite and Göktürk-2, first indigenous mini satellite of Turkey. Since 2014, he has been managing Turkey's first communication satellite project, TURKSAT 6A.

Lecture: Launch & Space Environment

The lecture is to teach the environmental conditions, including mechanical loads, thermal, radiation and electromagnetic environment, in all phases starting from the launch campaign until the end of whole life cycle of a spacecraft. Considering these environmental conditions, required elements of a sound verification process are also identified.

Assoc. Prof. Dr. Melin Şahin

Dr. Şahin received both B.Sc. and M.Sc. degrees from Department of Aeronautical Engineering at Middle East Technical University, Ankara, Turkey and PhD. degree from Ship Science Department in School of Engineering Sciences at University of Southampton, UK in 1996, 1999 and 2004, respectively. In 2004, he was a Postdoctoral Research Fellow at the Department of Ship Science in School of Engineering Sciences and Textile Conservation Centre in Winchester School of Art at University of Southampton, UK involving on a multidisciplinary project. In 2005, he joined the Middle East Technical University, Ankara, Turkey, where he is currently an Associate Professor in the Department of Aerospace Engineering. His research interests include smart structures, damage identification and health monitoring in light-weight and composite structures, structural dynamics, experimental analysis of vibrating structures, active vibration control and biomaterial and morphing structure applications.

Lecture: Experimental Analysis of Vibrating Structures

The lecture is designed to use the experimental techniques in vibration measurements and thus to provide the students especially for the ones working on structural dynamics, mechanical vibrations and modal testing areas by providing unique inside on the general understanding of vibration test planning, selection and use of exciters, transducers and sensors, data collection, processing and assessment in particular with hands on environment for modal analysis and testing. Therefore, the lecture mainly focuses on investigating structural vibrations by putting particular emphasize on the real application of experimental techniques in vibration measurements by maintaining the balance between theory and practical training. The content includes;

- Test planning, structure preparation and practical use of excitation equipment, recording and analysis of data,
- Practical use of transducers and sensors, recording and analysis of data,
- Modal testing and analysis of beam, plate and shell-like structures.

Assoc. Prof. Dr. Uluç Saranlı

Dr. Saranlı received his B.Sc. degree in Electrical and Electronics Engineering from the Middle East Technical University, Ankara, Turkey in 1996 and his M.Sc. and Ph.D. degrees in Computer Science from the University of Michigan, Ann Arbor in 1998 and 2002, respectively. He then joined the Robotics Institute in Carnegie Mellon University as a postdoctoral fellow until 2005. Subsequently, he served as an Assistant Professor in the Department of Computer Engineering in Bilkent University, Ankara, Turkey until 2011, after which he joined the Department of Computer Engineering in the Middle East Technical University as an Associate Professor. His research interests include the analysis and control of dynamic locomotion with legged robots, nonlinear dynamical systems, embedded systems, software architectures for robot programming and control and formal methods applied to planning and robotic autonomy.

Lecture: Embedded Software Development

This lecture covers the basic low-level components, tools and methods for developing embedded software on 8-bit microcontroller architectures. Trainees will be introduced to universally available embedded modules such as general purpose digital I/O, timers and interrupts, gaining hands-on experience on how to configure and use these modules within common software patterns in C. Lectures and hands-on laboratory sessions will allow trainees to gain a basic understanding of most low-level components underlying embedded subsystems within larger data acquisition and communication systems.

Mr. Xiaofeng Zheng

Mr. Zheng received his B.Sc. degree in Mechanical Design, Manufacturing and Automation from Nortwestern Polytechnical University and M.Sc. in Mechanical Engineering from Nortwestern Polytechnical University. He currently works at Changguang Satellite Technology Ltd. Co. at Satellite Structure Laboratory. His research interests are structural design, simulation and analysis.

Lecture: Assembly, Integration and Test

The Purpose of the lecture is to introduce several concept and process about the work of Assembly, Integration and Test (AIT) for satellite from a system engineering perspective. The trainees will comprehend the general procedure and criteria of the AIT work. The content are as follows:

- Concept of Assembly, Integration and Test
- General procedure and regulation of AIT
- Equipment to implement the AIT work
- AIT center: the cradle of satellite
- Examples of AIT work

Dr. Raşit Tutgun (Lecture: Communication System Testing)

Raşit Tutgun received the B.S., M.S. and Ph.D. degrees in electrical and electronics engineering in 2006, 2009 and 2015, respectively, from Hacettepe University, Ankara, Turkey. He currently works as a chief researcher and group leader of Communication Systems Group. His current research studies focus on communication system analysis and design, and signal processing for satellite communication systems, in particular high data rate downlink systems and TM/TC communication systems. He leads a research and development team developing communication subsystems for earth observation satellites, primarily for IMECE which is the first indigenous earth observation satellite of Turkey carrying electro-optic payload with sub-meter resolution.

Dr. Volkan Akan (Lecture: Communication System Testing)

Volkan Akan received B.S., M.S. and Ph.D. degrees in 2001, 2004 and 2012, respectively, all from the Department of Electrical and Electronics Engineering, Hacettepe University, Ankara, Turkey. Between 2001 and 2006, he was a Research Assistant at the same department. Since 2006 he has been working in TÜBİTAK UZAY. He is Chief Researcher and the Group Leader of Microwave and Antenna Systems Group. His specific research topics are RF/Microwave System Design, Antenna Design, Analysis Prototyping and Measurement (including space qualification), Passive RF/Microwave Element Design, Analysis, Prototyping and Testing, Numerical and Analytical Electromagnetic Analysis of Antennas, RF/Microwave Elements, and EMC Testing for space applications. From 2006 to 17 August 2011, he worked for RASAT which was the First Earth Observation LEO Satellite manufactured in Turkiye. Now, he leads Antenna subworkpackages for TM/TC and high data rate communication and works for EMC testings for earth observation satellites, primarily for IMECE which is the first indigenous earth observation satellite of Turkey carrying electro-optic payload with sub-meter resolution. Moreover, he works for the first Communication Satellite of Turkey, TURKSAT 6A, in the system level workpackages and EMC and Antenna testings.

Lecture: Communication System Testing

This lecture focus on the testing of communication modules based on the ECSS standards. The content is as follows:

- Theoretical background and main requirements of a communication module
- Detail test plan and scope of the tests
- Test procedures: Functional and environmental tests
- Evaluation of test results
- Theoretical background of Propagation for Satellite Communication,
- Some design requirements for antenna design
- Antenna measurements and evaluations.

Prof. Dr. M. Bilge Demirköz

Dr. Demirköz is a professor at the Middle East Technical University (METU) Department of Physics, working closely with CERN on two closely related subjects: measurement of cosmic rays in Earth's orbit and space radiation tests. She works on the data analysis from the Alpha Magnetic Spectrometer (AMS-02) on the International Space Station. Her group's current focus is the measurement of proton flux variability. She is also leading a project, called METU-DBL (Defocusing BeamLine) project, currently under construction in Ankara, Turkey, where Single Event Effects tests according to ESA-ESCC 25100 standards will be performed soon. Her group consists of 5 physicists, 6 engineers and 2 technicians. Dr. Demirköz an associate member of the Turkish Academy of Sciences and a member of the Global Young Academy.

Lecture: Space Environment and Radiation Testing

The first half of the lecture will be on different aspects of the space environment. How cosmics rays are produced, accelerated and reach the Earth and Solar effects resulting in the space radiation environment will be covered as well as the micro-gravity and plasma environment. The second half of the lecture will involve a site visit to the Turkish Atomic Energy Agency's Saraykoy Nuclear Research and Education Center. There will be a short introductory lecture introducing the site and basic radiation safety training. The group will then visit the Gamma Radiation Facility where a Co-60 source can be used for Total Ionizing Radiation testing and the Proton Accelerator Facility where METU-DBL is located as well as a Health Physics Center where dosimeters are calibrated.

Assoc. Prof. Dr. Mehran Mirshams (Lecture:Attitude Control)

Dr. Mehran Mirshams received his PhD degree from Moscow Aviation Institute (MAI), Moscow/Russia, in 2000 in the field of "Space System Engineering". He joined Aerospace faculty at K.N. Toosi University of Technology "KNTU" in 2000 and has been working as an academic staff since then there. He has designed two postgraduate educational programs at PhD and Master levels in Space System Engineering specialty in 2014 and 2001 respectively and run several joint educational programs with other universities in Moscow/Russia. He stablished Space Research Laboratory "SRL" (www.spacerl.com) in 2005 and in parallel with academic activity as the head of that Lab, has done more than 13 national research and development projects in space engineering fields. More than 4 PhD and 38 MS degree students, have been graduated under his guidance. He has published more than 46 papers in reputed international journals and about 145 national or international conferences. He is in the head of APSCO SSS-1 Attitude Determination and Control Subsystem (ADCS) designed and development team at SRL, K.N. Toosi University of Technology, Tehran/Iran.

Lecture: ADCS Micro-Simulator Hands-on Training

- Introduction & Content
- Test set up (ADCS Micro-Simulator) introduction and demo
- Workshop Assignment, its breakdown and working groups' arrangement (8 teams)
- ADCS Model Subsystems and Software introduction(Hands-on training)
- ADCS Micro-Simulator Assembly, Integration and programming (Team working)
- ADCS Model tests and justification, with the help of designed controller (Team working)
- Teams assignment's results evaluation

In the workshop, trainees based on a practical example and with the use of user friendly Micro-Simulator, will train, how to build a simple plug and play satellite ADCS model and make it work.

Dr. Halil Ersin Söken

Dr. Söken graduated "Summa cum Laude" from Astronautical Engineering Department of Istanbul Technical University, Turkey in 2007. He earned his PhD. in Space and Astronautical Science from the Graduate University for Advanced Studies (Sökendai), Japan in 2013. During his PhD. studies he was a visiting researcher in Aalborg University, Denmark for 3 months. For last 3 years he was an aerospace project research associate at the Institute of Space and Astronautical Science (ISAS), Japan Aerospace Exploration Agency (JAXA). Currently he is post-doc system researcher for ISAS and contributing to the implementation of an advanced attitude determination algorithm for JAXA's ERG spacecraft. His research fields are spacecraft attitude determination and control, and guidance and navigation for aerial vehicles with specific interest in adaptive estimation and Kalman filtering. He has 1 co-authored book, 18 published journal papers, 5 book chapters and more than 40 peer-reviewed papers presented at international conferences.

Lecture: Attitude Determination for Small Satellites: Challenges and Solutions

The lecture covers attitude determination system (ADS) design for small satellites. The main emphasis will be given to the challenges we have for small satellite ADSs and the proposed solutions. First, we will define what is "attitude" and introduce the necessary fundamentals such as coordinate systems, spacecraft dynamics & kinematics. Next, we will discuss possible ADS implementations for small satellites with a discussion on the hardware selection. We will see different attitude determination approaches, specifically different algorithms that we can use for small satellite attitude determination considering the system limitations. This part will also contain examples such as attitude determination from vector measurements and Kalman filtering for attitude estimation. In the final part, we will discuss some advanced topics for small satellite attitude determination including the in-flight calibration of attitude sensors.

Mr. Barış ÇOLAK

Barış Çolak received both BSc. and MSc. degrees from Electrical and Electronics Engineering of the Middle East Technical University, Ankara, Turkey in 1998 and 2002, respectively. Since 1999, he works as a senior research engineer in TÜBİTAK Space Technologies Research Institute (formerly TÜBİTAK BILTEN before 2006), Ankara, Turkey and is the leader of Platform Power Systems Group. He participated in all stages of the first two indigenously built satellites of Turkey (RASAT and GOKTURK 2) as a power systems engineer. He is currently involved in the design of a power subsystem, reaction wheel equipment and antenna pointing mechanism for LEO imaging satellite and GEO communication satellite projects. His main specialty fields are power electronics and motor drive control electronics.

Lecture: Power System of Satellites

The purpose of the lecture is to give a basic understanding of the analyzing, budgeting, designing, manufacturing and testing stages of the power system of a satellite. First, a mission analysis will be demonstrated to specify the needs of the power system. The power budget will be generated according to different operation scenarios of the satellite. The alternative designs will be investigated considering the different topologies of the power stage and the interactions between power system and other systems of the

satellite will be analyzed to show their effect on the design process. Hardware of the engineering or qualification models of the previous projects will be examined to let the students have the insight of the practical aspects of manufacturing and testing processes.

Mr. Mustafa Türkmenoğlu

Mustafa Türkmenoğlu, TÜBİTAK Space Technologies Research Institute, Chief Researcher. Research Fields: System Engineering, Thermal Vacuum Testing, Thermal Design and Analysis, Equipment and System Level Environmental Testing and Verification Activities, Assembly Integration and Testing.

Lecture: Thermal Cycle
The lecture is going to be about:

- Philosophy of Verification and Testing
- Test Effectiveness
- ECSS Testing Standard
- Introduction to Thermal Testing and Verification
- Thermal Test Levels and Durations
- Thermal Vacuum/Thermal Test Facilities
- Preparation of Thermal Testing and Specifications
- Thermal Test Practices and Demonstrations

Name List of Teams

Country	Team Leader	Members
Bangladesh	Dr. Z. M. Parvez Sazzad	Mr. Md. Sadman Siraj Mr. Swapnil Sayan Saha Ms. Quazi Rushnan Islam Ms. Sheikh Fariha Hossain
BUAA China	Prof. Huang Hai	Mr. Fan Boyu Mr. Feng Jiqin Mr. Wang Zhiwen
SJTU China	Dr. Wang Xiaoliang	Mr. Huang Yixin
Iran	Dr. Taleb Abdollahi	Ms. Niki Sajjad Ms. Hamideh Esmaeili Mr. Mohsen Delshad Noughabi Mr. Mohammad Ali Torkaman Asadi
Mongolia	Mr. Uuganbayar Purevdorj	Mr. Anand Magsardorj Mr. Byambajargal Lhagvaa Mr. Bilguun Saintuya Mr. Garid Zorigoo
Pakistan	Dr. Rehan Mehmood	Ms. Sadaf Ahsan Khokar Mr. Muhammad Danish Mr. Muhammad Ali Afzal Mr. Hassan Ali
Peru	Ms. Luz Antuanet Adanaque Infante	Ms. Melissa Sonia Yactayo Yaranga Ms. Anyela Del Pilar Listh Aquino Velasquez Mr. Gonzalo Manuel Tineo Mendoza Mr. Jhonnell Carlos Fernandez Cornejo
Thailand	Dr. Chaiwat Klampol	Mr. Suphongsa Khetkeeree Mr. Chaleampon Photeam Mr. Norawit Nangsue Mr. Sumeth Klomchitcharoen
Turkey	Mr. Süleyman Altınışık	Mr. Halis Abdullah Özçelik Ms. İldeniz Öztürk Mr. Ali Kaan Güven Mr. Mücahit Taşdemir

Turkey	Ms. Şulenur Altunay
	Ms. Aytuğ Becenen
	Mr. Kamil Canberk Atik
	Ms. Dilara Aksakboğa
	Mr. Yağız Kurt
	Ms. Chiamaka Doris Ikezeora
	Mr. Muhammed Asif Saeed
	Mr. İbrahim Karakaya
	Ms. Sibel Kaçmaz
	Mr. Mucahit Furkan Önal
	Mr. Mert Gökduman
	Mr. Berkay Daşer
	Ms. Hazal Önce
	Mr. Mert Can
	Ms. Merve Demircan

Campus Map

ODTÜ

KAMPUS HARİTASI
01.2013

DUMLUPINAR BULVARI

A1 KAPISI
KUZEY KAPISI

ATATÜRK
EĞİTİM VE
ARAŞTIRMA
HASTANESİ

A7 KAPISI
BATI KAPISI

BİLKENT
BULVARI

YAPI İŞLERİ VE
TEKNİK DAİRE BAŞKANLIĞI
ALTYAPI HİZMETLERİ

VİŞNELİK
TESİSLERİ

TAI   SATGEB
HAVELSAN
ASELSAN

ARITMA
TESİSİ

A4 KAPISI
DOĞU KAPISI

AYSEL SABUNCU
YAŞAM MERKEZİ

DİNİ
TESİS

Ha   Hb   K   Aa   Ab   Af   Ae   Ac   Ad   Hc   Sa   La   M   Sb   Ya   Yb   Lb   Sc   T

M MARKET	**La-Lb** LOJMAN		
Aa-Af AKADEMİK	**Sa-Sc** SPOR		
Ha-Hc HİZMET	**T** ODTÜ TEKNOKENT		
K KOLEJ	**Ya-Yb** YURT		

Lejand

0   100m   200m

2. YOL
10. YOL
9. YOL
1. YOL
4. YOL
5. YOL
8. YOL

Location	Code
Aerospace Engineering	Ad 14
Aerospace Engineering Laboratory	Ad 15
Archaeological Museum	Ab 15
Architecture	Ab 14
Architecture Amphitheater	Ab 13
Arka Bahce Cafe	Ya 14
Ayaslı Research Center	Ac 24
Basic English A Block	Aa 12
Basic English B, C Blocks	Aa 11
Basic English D Block	Aa 9
Basic English E Block	Aa 10
Basic English F Block	Aa 11
Basic English G Block	Aa 7
Basic English Self Access Centre	Aa 8
BILTIR	Ae 2
BILTIR Vehicle Safety Unit	Ae 3
Biological Sciences	Af 2
Biology	Af 2
BIOMATEN	Ac 34
Bookstore	M 5
Business Administration	Af 1
Cafeteria	Ac 1
Central Engineering Building (MM)	Ac 4
Central Laboratory	Ac 22
Chemical Engineering A Block	Ac 15
Chemical Engineering B, C, E Blocks	Ac 13
Chemical Engineering D Block	Ac 18
Chemistry A, B, C, D Blocks	Ac 39
Chemistry Education	Aa 3
City and Regional Planning	Ab 14
Civil Engineering K1, K6 Blockst	Ac 10
Civil Engineering K2 Block	Ac 11
Civil Engineering K3 Block	Ac 12
Civil Engineering K4 Block	Ac 1
Civil Engineering K5 Block	Ac 2
Computer Center	Ac 8
Computer Educ. & Instructional Tech.	Aa 2
Computer Engineering	Ac 6
Continuing Education Center	T 6
Cryptology Laboratory	Ae 1
Cultural and Convention Center (CCC)	Hc 2
Çatı Cafe	Ac 31
Directorate of Admin. & Financial Affairs	Ac 4
Directorate of Health, Culture & Sports	Ab 3
Directorate of Personnel Affairs	Ab 3
Directorate of Strategy Development	Ab 3
Directorate of Student Affairs	Ab 3
Disability Support Office	Ab 2
Dorm 1	Ya 1
Dorm 2	Ya 2
Dorm 3	Ya 3
Dorm 4	Ya 4
Dorm 5	Ya 5
Dorm 6	Ya 6
Dorm 7	Ya 7
Dorm 8	Ya 8
Dorm 9	Ya 9
Dorm 19	Yb 3
Dorm - Ebi Guesthouse 2	Ya 10
Dorm - Faik Hızıroğlu	Ya 16
Dorm - Faika Demiray	Yb 2
Dorm - İsa Demiray	Yb 1
Dorm - Osman Yazıcı	Ya 17
Dorm - Refika Aksoy	Yb 4
Dorm - Student Guesthouse 1	Ya 14
Dorm - Student Guesthouse 2	Ya 15
Doyurucu Cafe	M 3
Early Childhood Education	Aa 3
Economics	Ab 1
Electrical and Elect. Eng. A Block	Ac 30
Electrical and Elect. Eng. B, C, D Blocks	Ac 27
Electrical and Elect. Eng. E Block	Ac 26
Electrical and Elect. Eng. F Block	Ac 25
Elementary Mathematics Education	Aa 3
Elementary Science Education	Aa 3
English Language Teaching	Aa 1
Environmental Engineering	Ad 3
Faculty Club	Hc 1
Faculty Housing	La 1
Fac. of Architecture	Ab 14
Fac. of Architecture, New Building	Ab 12
Fac. of Arts and Sciences	Ab 5
Fac. of Econ. & Admin. Sciences A Block	Ab 1
Fac. of Econ. & Admin. Sciences B Block	Af 1
Faculty of Education	Aa 3
Faculty of Engineering	Ac 4
Fitness Center	Sb 5
Food Engineering	Ad 13
Gallium Block	T 8
Geological Engineering & Geo. Museum	Ad 8
GISAM	Aa 4
Grad. Sch. of Applied Mathematics	Ab 5
Grad. Sch. of Informatics	Ae 13
Grad. Sch. of Natural & Applied Sciences	Ac 4
Grad. Sch. of Social Sciences	Ac 4
Gymnastics Hall	Sb 2
Halıcı Software House	T 7
History	Ab 11
Indoor Pool	Sb 3
Indoor Tennis Courts	Sa 1
Industrial Design	Ab 14
Industrial Engineering	Ac 33
International Cooperations Office	Ab 2
International Relations	Af 1
International Students' Office	Ab 3
Kindergarten	Ab 10
Library	Ab 2
Mathematics	Ab 9
MATPUM	Af 5
Mechanical Engineering A Block	Ac 20
Mechanical Engineering B Block	Ac 19
Mechanical Engineering C Block	Ac 21
Mechanical Engineering D Block	Ae 10
Mechanical Engineering E Block	Ae 9
Mechanical Engineering F Block	Ae 8
Mechanical Engineering G Block	Ae 7
Medical Center	Ya 11
Metallurgical and Materials Eng. A, B, C Blocks	Ad 4
Metallurgical and Materials Eng. D Block	Ad 5
Metallurgical and Materials Eng. E Block	Ad 6
METU College	K 1
METU Guesthouse	La 2
METU Teknokent Twins Building	T 10
MilSOFT R&D	T 9
Mining Engineering	Ad 10
Mining Eng. Mineral Processing Lab.	Ad 10
Modern Languages	Ab 5
MODSIMMER	Af 3
Molecular Biology and Genetics	Af 2
Music and Fine Arts	Ab 2
ODTÜ Kent Residential Area	Lb 1
ODTÜ Kent Guesthouse	Lb 2
Office of Social Facilities - METU Store	Ac 2
Outdoor Pool	Sb 4
Petroleum and Natural Gas Engineering	Ad 12
Petroleum Research Center	Ad 11
Philosophy	Ab 11
Physics	Ab 6
Physics Education	Aa 3
Political Science and Public Admin.	Ab 1
President's Office	Ab 3
Psychological Counseling and Guidance	Ab 9
Psychology	Ab 11
PTT (Post Office)	M 8
Quantum Devices & Nano-photonics Research Laboratory	Ac 23
SATGEB (Aselsan, Havelsan, TAI)	T 13
School of Foreign Languages	Aa 11
Science and Technology Museum	T 1
Shopping Center (EBI)	M 1
Shopping Center (EBI 2)	M 7
Silicon Block	T 2
Silver Blocks	T 3
Social Sciences Building	Ab 11
Sociology	Ab 11
Sports Center	Sc 1
Stadium	Sb 1
Statistics	Ac 35
Student Clubs - Baraka	Ac 3
Student Cultural Center	Ya 13
Sunshine Cafe	Ya 12
Supermarket Şok	M 2
Supermarket Dia	Sc 2
Tech. Vocational School of Higher Educ.	Aa 1
TEKMER (METU - Kosgeb)	T 5
Titanium Block	T 4
TUBITAK SAGE	Ae 11
TUBITAK Uzay	Ae 12
Turkish Classical Music Society (KTMT)	Ae 4
Turkish Folklore Club (THBT)	Ae 4
Turkish Language	Ac 14
Türk Telekom R&D Building	T 17
U-Auditorium	Ab 8
Welding Technology and Non-Destructive	Ad 7