

Workshop on Advances in Micro Gas Turbine Cycle Modeling and Turbine Hot Section Design Practices

Date: Tuesday, November 15th, 2016 (08:30-17:30)

Location: Faculty of Aerospace Engineering - Faculty Auditorium

The training activities will be open for all students, industry and academic staff. There is no cost for registration; however it is mandatory for all participants. Please reserve your spot until 8/11/2016 by contacting Vered Seginer <veredseg@ae.technion.ac.il>.

Program

08:30 - 08:45 *Registration and Introduction*

Mr. Joachim Kurzke

08:45 - 09:30 **How Gas Turbine Performance Programs Work**

- Performance Program Examples
- Numerical Technique for Off Design
- Some Special Details

09:30 – 09:40 *Short Break*

09:40 - 10:25 **GasTurb 13 Program Demonstration**

- Cycle Design
- Off-Design

10:25 - 10:45 *Coffee Break*

10:45 - 11:30 **Compressor Performance**

- Compressor Map Coordinates
- Variable Guide Vanes
- Fan Maps
- Scaling Maps

11:30 – 11:40 *Short Break*

11:40 – 12:30 **Modeling the CFM56-3**

- Check of the Data
- Cycle Reference Point
- Off-Design
- Preliminary Model Calibration
- Refined Model

❖ *12:30 - 13:30 Break (Light Lunch will be served)*

13:30 – 14:20 **Combustor and nozzle entry transition**

- Combustor liner and dome thermo-mechanical issues
- Impact of exit temperature pattern factor and radial profile on durability
- Combustor-st.1 nozzle transition in combination with endwall cooling

14:20 – 14:30 *Short Break*

14:30 – 15:20 **Turbine vanes and blades**

- Thermo-mechanical limits for st.1 nozzle and blade,
- Integral versus separate nozzle/blade tip shroud (over-tip stator) support
- Vane and blade air cooling design techniques
- Cooling air delivery systems; leading edge, blade tip and trailing edge cooling

15:20 - 15:40 *Coffee Break*

15:40 - 16:30 **Tip clearance and turbine interior air flows**

- Transient thermal-mechanical behavior of turbine components affecting tip clearance
- Tip clearance effect on turbine performance
- Importance and various options for sealing the turbine disc cavity
- Passive/active tip clearance control
- Inter-stage diaphragms and seals
- Secondary air flow system

16:30 – 16:40 *Short Break*

16:40 – 17:30 **Engine Uprates**

- Performance uprates with turbine cooling in micro-turbines and aero-engines
- Main strategies in design of aero derivative industrial engines

Bio:

Mr. Joachim Kurzke



Education:

1963-1969 Aero & Space Technology at the Technical University of Munich.

Doctorate 1976

Employment History:

1969 - 1976 Assistant Professor Technical University of Munich, Flight Propulsion Institute

1976 - 2004 MTU Aero Engines, Engine Performance Department

Engine Projects: RB199, MTR390, PW 300, PW 500, PW2000, PW4090, EJ200 and others

1980 - 1985 Development of the MTU Modular Performance Simulation Program MOPS, since 1997 development of the MOPS derivative MOPEDS

1985 - 1991 MTU Representative and Chairman of the international EJ200 Performance Working Group

1993 - 2000 Head of Engine Performance Department at MTU

Since 2004 Gas turbine performance consultant

Since 1991 Development of GasTurb

GasTurb is a cycle program which is used worldwide at Universities and in industry. **www.gasturb.de**

Dr. Boris Glezer



Over his 50 years of gas turbine design and research career Dr. Boris Glezer has established US national as well as world reputation in the field of turbine cooling and transient hot section behavior. He is a Fellow of ASME and a member of major IGTI committees. His early successful engineering and academic development began in the former Soviet Union where, after earning his PhD degree, he has become a leader for advancement of industrial gas turbines operating in Gasprom pipeline system.

Soon after immigrating to US in 1980 Boris became a team leader for turbine hot section design and then a Chief Engineer at Solar Turbines Inc. with responsibilities for turbine cooling design and heat transfer analysis. During his years with Solar Turbines Dr. Glezer was awarded 18 US/international patents and published over 40 papers in professional journals as well as separate chapters in 3 books, including Turbomachinery Handbook. Being an owner of consulting firm "Optimized Turbine Solutions" Boris combined his consulting activity with teaching at universities and lecturing at VKI, Belgium. Over the last few years he was invited to AE faculty of the Technion to teach a number of advanced gas turbine courses and to assist in the faculty research.