

**DEPARTMENT OF THERMAL POWER ENGINEERING****Head of Department:**

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<http://www.kte.sjf.stuba.sk>**I. STAFF****Professors***Vojtech Molnár*, D.Sc., Prof.

Professor in: Power Engineering

Research topics: General Power Engineering. Fluid Mechanics and Thermodynamics of Turbomachinery, Computational Fluid Dynamics

**Associate professors***Pavel Michalec*, PhD., Assoc. Prof.

Associate Professor in: Thermal Power Engineering

Research topics: Optimal heat supply and heat utilization

*František Urban*, PhD., Assoc. Prof.

Associate Professor in: Thermal Power Engineering

Research topics: Nuclear Power Plants, Energy production and utilization, Economy

Senior lecturers: 4

Research workers: 1

PhD. students: 5 (4 internal, 1 external)

Technical staff: 2

**II. EQUIPMENT****II.1 Teaching and Research Laboratories****Turbomachinery Laboratory**

Equipment:

1 MW gas turbine, 500 kW, 100 kW and 35 kW steam turbines and a 250 kW experimental turbocompressor. The electric drive of the compressor has a continuously controlled speed in the range of 0 to 1520 rev/min. Maximum rotor speed is 14 000 rev/min. A direct-torque measuring device is installed. The design of the compressor allows for a combination of different radial wheels and vanes or vaneless diffusers. The measuring equipment forms accessories for the compressor, which enables measuring of the compressors characteristics. The

compressor serves as an air supply source and the testing model may be mounted on the inlet or outlet of the machine.

**Areas of Application:**

The laboratory serves for experimental seminars as well as for the research of radial compressor components, e.g. compressor wheels with radial, forward and backward swept blades with vane diffuser, channel diffuser and spiral diffuser.

**Aerodynamics Laboratory**

**Equipment:**

An AT-2 wind tunnel for flow experiments of extremely enlarged models with a testing chamber 1000 x 800 mm. An experimental radial compressor for flow research in the rotor, diffuser and reverse channel. Individual micro-probe manufacturing, together with a transverse device, supported by an automatically operated, computer controlled, calibrating tunnel. The calibrating system provides calibration possibilities of up to 150 m/s, and progressively up to 300 m/s. The above mentioned equipment is also used for applied research.

**Areas of Application:**

Measuring of model turbine blades, buildings, bridges, with dimension up to 1000x800 mm.

**Computational Fluid Dynamics Laboratory**

**Equipment:**

Includes Pentium based multiprocessor servers and terminal networks. Professional software available for complex flow analysis specialized for turbomachinery component modeling, heat transfer modeling and turbulence modeling. Other professional software packages are destined for general flow analysis in complex applications. Additional software used in the laboratory are department developed.

**Areas of Application:**

General flow analysis in energy systems

**II.2 Special Measuring Instruments and Systems**

- A wind tunnel for low velocity flow experiments of extremely enlarged models
- Experimental radial compressor for flow measurements in the rotor, diffuser and reversing channel
- Small 5-hole pneumatic probes with traversing equipment
- Completely automatic probes
- Heat exchangers
- Fuel testing apparatus
- CTA System Stream Line

### III. TEACHING

#### III.1 Undergraduate Study

Name of subject	semester	hours per week		reader's name
		lectures	seminars	
Power Technology	5	2-2		F. Ridzoň
Boiler Technology and Heat Exchangers	6	3-2		S. Malý
Operation of Heat Energy Facilities	6	3-2		L. Kučák

#### III.2 Graduate Study

Name of subject	semester	hours per week		reader's name
		lectures	seminars	
Energy Sources and Conversion I	7	3-0		L. Kučák
Boiler Technology and Heat Exchangers I	7	3-0		S. Malý
Computer Fluid Dynamics	7	3-0		V. Molnár
Power Systems I	7	3-0		P. Michalec
Power Engineering	7	3-0		J. Hadrik
Semester Work	7	0-10		V. Molnár
Energy Sources and Conversion II	8	3-0		L. Kučák
Boiler Technology and Heat Exchangers II	8	3-0		S. Malý
Theory of Turbomachinery	8	3-0		V. Molnár
Semester Work	8	0-10		V. Molnár
Nuclear Power Plants	8	3-0		F. Urban
Power Systems II	8	3-0		P. Michalec
Semester Work	9	0-8		V. Molnár
Steam and Gas Turbines	9	3-0		F. Ridzoň
Power Engineering Management	9	3-0		F. Urban
Pumps in Power Engineering	9	3-0		M. Varchola
Combustion Engines in Power Engineering	9	3-0		M. Polóni
Electrical Equipment for Power Engineering	9	3-0		E. Brutovský
Diploma Project	10	0-22		V. Molnár

### IV. RESEARCH TARGETS

Basic Research Areas:

- Secondary flow and losses in turbomachine blade rows
- Burner aerodynamics for steam boilers
- Software development for CFD

Applied Research Areas:

- Aerodynamics of Turbomachinery
- Aerodynamics of Combustors
- Emissions reduction
- Power Systems Analysis
- Central Heat Supply Systems

## **V. RESEARCH PROJECTS**

Grant Projects:

- Flow measurements in a cascade with a low aspect ratio and end-wall contouring
- Safety, Reliability and Economics for Environmentally-Friendly Power Sources and their Intergration in Power Engineering Systems

Contracted Activities:

- Thermodynamic Recalculation for Prescribing Hot Gases Temperatures
- Evaluating the Utilization of Fuel Cells in Slovak Power Engineering

## **VI. COOPERATION**

### **VI.1 Cooperation in Slovakia**

- Nuclear Power Plant, Jaslovské Bohunice
- Nuclear Power Plant, Mochovce
- West Slovakia Power Co., Bratislava
- Slovak Power Machinery Works, Tlmače
- Power Plant, Vojany
- Slovak Power Company, Bratislava
- SPP (Slovak Gas Industry), Bratislava
- ZSNP Žiar nad Hronom

### **VI.2 International Cooperation**

- TU Darmstadt, Germany
- TU Vienna, Austria
- FH Joanneum Research Centre, Graz, Austria

### **VI.5 Membership in Domestic Organizations and Societies**

- Ľ. Kučák - Slovak Nuclear Society, Bratislava
- Ľ. Kučák - Slovak Association of Mechanical Engineers, Bratislava
- F. Urban - Slovak Nuclear Society, Bratislava
- F. Urban - Slovak Association of Mechanical Engineers, Bratislava
- S. Malý - Member of Energy Section, Slovak Industry and Business Board, Bratislava
- P. Michalec - Slovak Heat Energy Union
- P. Michalec - Member of Editorial Staff in Journal *Energia*
- V. Molnár - Member of Editorial Staff in Journal *Strojnícky časopis* (Mechanical Engineering)

## VI.6 Membership in International Organizations and Societies

- V. Molnár - International Society for Air Breathing Engines, USA
- V. Molnár - VDI, Germany

## VI.8 Visits of Staff Members and Postgraduate Students to Foreign Institutions

- J. Hadrik – Czech republic (2 days)
- P. Kosečková – Czech republic (2 days)
- T. Čekan – Czech republic (2 days)
- M. Vančo – Czech republic (2 days)
- Ľ. Kučák – Czech republic (2 days)
- F. Urban – Czech republic (2 days)

## VII. THESES

### VII.1 PhD. Thesis

- [1] Hlbočan, J.: *Secondary Flow in a Turbine Cascade*

### VII.2 Graduate Theses (Diploma Works)

(Supervisor's name in the brackets)

- |   |             |
|---|-------------|
| [1] Hribík, J.: <i>Redesign of AT2 Tunnel for Measuring VS33 Reaction Linear Cascade</i>                  | (V. Molnár) |
| [2] Kopjár, P.: <i>Gas turbine with Inter-cooling and Reheat</i>  | (J. Hadrik) |
| [3] Kováč, M.: <i>Experimental Equipment for Scientific Measurement of Low Output Boilers and Heaters</i> | (F. Urban)  |
| [4] Nagy, J.: <i>Experimental Device for Calibration of Five-hole Pressure Probes</i>                     | (V. Molnár) |
| [5] Senáši, P.: <i>Evaporative Gas Turbine</i>  | (J. Hadrik) |
| [6] Sivák, M.: <i>Equipment for Measuring Pump Characteristics</i>  | (V. Molnár) |
| [7] Trčko, M.: <i>Joint Production of Electrical power, Heat and Cooling – Design of air cooler</i>       | (V. Molnár) |
| [8] Zahoran, R.: <i>Small Experimental Gas Turbine Project</i>  | (V. Molnár) |

### VII.3 Bachelor Theses

(Supervisor's name in the brackets)

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|--|-------------|
| [1] Andrejčík, M.: <i>Heating System with Utilization of Solar Energy</i>  | (Ľ. Kučák)  |
| [2] Čambala, R.: <i>Heating System with Utilization of Solar Energy</i>  | (Ľ. Kučák)  |
| [3] Domáň, M.: <i>Geometrical Resources</i>  | (Ľ. Kučák)  |
| [4] Kandráč, M.: <i>Applying Method of Probability Engineering for the Reliable Analysis of Emergency System Hook-up in Power Engineering Operations</i> | (J. Vlnka)  |
| [5] Kollár, P.: <i>Low Performance Wind Turbine</i>  | (V. Molnár) |
| [6] Lehocký, Ľ.: <i>Local Automatic Fire Extinguishing Equipment</i>   |             |

for Power Engineering Equipment

(M. Kamenský)

[7] Petříček, B.: *Economic Power Engineering Hydraulic Systems*

(K. Prikkel)

[8] Szimonisz, M.: *Pump System with Double Water Tanks Project*

(P. Tóth)

## VIII. OTHER ACTIVITIES

- V. Molnár - Organization Committee Member of the 6th European Conference on Turbomachinery (Fluid Dynamics and Thermodynamics)
- V. Molnár - Member of the University Consortium Committee
- V. Molnár - Member of the D.Sc. Defense Committee
- F. Urban - Member of the University Consortium Committee
- Active participation in Scientific Conferences
- Professional assessments (opponent assessment of academic habilitation papers, opponent assessment of academic dissertation papers, opponent assessment of thesis papers, opponent assessment of conclusion reports, opponent assessment of granted projects, opponent assessment of monographs, assessment review of conference contributions, assessment review of lecture notes, post-graduate dissertation paper projects, research reports)

## IX. PUBLICATIONS

- [1] Čekan, T., Molnár, V.: Experimental CFD Code for Viscous Transonic Flow Analysis. Proceedings of the International Conference Power Engineering Machines – Thermomechanics – Fluid Dynamics – 2004, Plzeň, 2004
- [2] Hadrik, J.: *Model Equipment for Removing CO<sub>2</sub> in Hot Gases*. Proceedings of the International Conference Power Engineering Machines – Thermomechanics – Fluid Dynamics – 2004, Plzeň 2004 (in Slovak)
- [3] Hadrik, J.: *Model Equipment for Removing CO<sub>2</sub> in Hot Gases*. In: Energia, Vol. 6, 2/2004 (in Slovak)
- [4] Kabát, V., Malý, S.: *Problems in Steam boilers a Steam Generators*. Proceedings of the 12<sup>th</sup> International Conference Heating 2004, Tatranské Matliare, 2004 (in Slovak)
- [5] Kabát, V., Urban, F., Kučák, L., Malý, S.: *Audit on Power Engineering Economy in Hospitals*. Proceedings of the 12<sup>th</sup> International Conference Heating 2004, Tatranské Matliare, 2004 (in Slovak)
- [6] Kosečeková, P., Molnár, V.: *Combination Generation of Electrical Energy – Heat – Cold Air*. In: Energia, Vol. 6, 1/2004 (in Slovak)
- [7] Kosečeková, P., Molnár, V.: *Combination Generation of Electrical Energy – Heat – Cold Air*. In: Energia Slovgas, Vol. XIII, 3/2004 (in Slovak)
- [8] Kosečeková, P., Molnár, V.: *Combination Generation of Electrical Energy – Heat – Cold Air*. Proceedings of the 12<sup>th</sup> International Conference Heating 2004, Tatranské Matliare, 2004 (in Slovak)
- [9] Kosečeková, P., Molnár, V.: *Gas Turbine Cooling*. Proceedings of the International Conference Power Engineering Machines – Thermomechanics – Fluid Dynamics – 2004, Plzeň, 2004 (in Slovak)

- [10] Kučák, Ľ., Urban, F.: Determination of Expansion Curves for Steam Turbines by Guaranteed Measurements. Book of Abstracts. XIV. International Scientific Conference "Application of Experimental and Numerical Methods in Fluid Mechanics". Rajecké Teplice, 2004 (in Slovak)
- [11] Malý, S., Kabát, V.: *Potential Power Engineering Utilization of Biogas in Cogeneration Units*. In: Energia, Vol. 6, 4/2004 (in Slovak)
- [12] Malý, S., Kabát, V.: *Utilization of Natural Gas Pressure Energy in Gas Boiler Regulation Stations for Generation of Electrical Energy*. In: Energia, Vol. 6, 3/2004 (in Slovak)
- [13] Michalec, P., Mereš, B.: *Influence of Operating Parameters on Heat Losses*. Proceedings of the 12<sup>th</sup> International Conference Heating 2004, Tatranské Matliare, 2004 (in Slovak)
- [14] Molnár, V., Ridzoň, F., Vančo, M., Hlbočná, J.: *Flow Studies in Cascade with Profiled End-wall*. Proceedings of the International Conference Power Engineering Machines – Thermomechanics – Fluid Dynamics – 2004, Plzeň, 2004 (in Slovak)
- [15] Muškát, P., Urban, F.: *Experimental Equipment for Low Output Boiler Measurements*. Proceedings of the 12<sup>th</sup> International Conference Heating 2004, Tatranské Matliare, 2004 (in Slovak)
- [16] Muškát, P.: *Thermodynamic and Hydrodynamic Ratios in Experimental Equipment for Measuring on Low Output Boilers*. Proceedings of abstracts, the XIV<sup>th</sup> International Scientific Conference Application of Experimental and Numerical Methods in Fluid Mechanics, Rajecké Teplice, 2004 (in Slovak)
- [17] Urban, F., Kučák, Ľ., Kabát, V., Malý, S.: *Reducing Heat and Electricity Costs in Hospitals*. Proceedings of the 6<sup>th</sup> International Conference Rational Production, Transfer and Consumption of Energy, Malá Lučivná, 2004. Acta Mechanica Slovaca, Vol. 8, 3-A/2004 (in Slovak)
- [18] Urban, F., Kučák, Ľ., Muškát, P.: *Determining Efficiency of Water Separator In Nuclear Power Plant Separator*. Proceedings of abstracts, the XIV<sup>th</sup> International Scientific Conference Application of Experimental and Numerical Methods in Fluid Mechanics, Rajecké Teplice, 2004 (in Slovak)
- [19] Urban, F., Kučák, Ľ.: *Analysis of Heating Costs for End Consumers*. Proceedings of the 6<sup>th</sup> International Conference Rational Production, Transfer and Consumption of Energy, Malá Lučivná 2004. Acta Mechanica Slovaca, Vol. 8, 3-A/2004 (in Slovak)
- [20] Urban, F., Kučák, Ľ.: *Heat Price Comparisons for Heating Sources*. Proceedings of the 12<sup>th</sup> International Conference Heating 2004, Tatranské Matliare, 2004 (in Slovak)