



## MediaInfo

Forschungsvereinigung Verbrennungskraftmaschinen e.V.  
FVV | Research Association for Combustion Engines

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### **Digital Simulations for Real World Engines and Turbines: FVV awards Hans Dinger Prize for Young Researchers**

**New digital simulation methods allow engineers to develop clean and sustainable engines and turbines. This is the conclusion of the 2016 contest of the Hans Dinger Prize (HDP). The Forschungsvereinigung Verbrennungskraftmaschinen (FVV, Research Association for Combustion Engines) awarded its young researchers prize for the sixth time this year. It recognises the excellence of the scientific work of young scientists contributing to the success of the association's industrial collective research (IGF) projects. This year's awardees are graduates from the universities of Aachen, Hannover and Stuttgart. The winner received 3,000 Euros.**

**Frankfurt/Main.** // The 2016 award went to Lukas Berger, RWTH Aachen University, who studied in his master thesis the formation of soot emissions in aircraft gas turbine engines and developed a very fast operating simulation tool to enhance the prediction of the emissions.

#### **Developing next-generation gas turbines with lower emissions**

The FVV research project from which Lukas Berger's master thesis has emerged dealt with a theoretical predictive model development of gas turbine emissions. Basically, developers may revert to various state-of-the-art simulation methods which differ in their level of detail. Direct Numerical Simulations (DNS) operate with a high accuracy which is comparable to experimental validations. However, due to their high computational burden they cannot be applied to real world aero engines. That was the starting point of Berger's master thesis: The aim was to investigate into the soot-turbulence interaction in a gas turbine combustion chamber on the basis of DNS data and to use these findings for simple Large-Eddy-Simulations (LES). By using a self-developed software he identified those DNS parameters that are relevant for modelling the formation of soot emissions. In a next step, the young researcher developed an LES model to describe soot formation mechanisms for turbulent flames, which reduces the modelling errors by 50 per cent compared to existing approaches. "This model allows to predict soot-turbulence interactions in a fast and efficient way, which is a prerequisite for the design of next-generation low-emission gas turbines", says Univ.-Prof. Dr.-Ing. Heinz Pitsch, Director of the Institute for Combustion Technology (ITV) at RWTH Aachen University.

### **Broadening the understanding of catalysts**

The effectiveness of a catalytic converter depends on its operating temperature and various other factors. For catalysts that contain platinum or palladium as reactive component, FVV has studied in a research project the composition of a diesel oxidation catalyst, its aging and the noble metal oxide formation. With his winning second place master thesis, Florian Bühner, University of Stuttgart, contributed to the overall project findings experimental validations on the chemistry of the reactions taking place on the catalyst. In addition, he established a mathematical model for chemical reaction kinetics by taking into account the dynamic processes of noble metal oxide formation and reduction during catalyst operation. It turned out that Bühner's mathematical calculations were identical with values well-known from the literature. "This master thesis contributes to a better understanding of reaction kinetics. By comparing additional experimental validations with the simulations, the model's design process could be further substantiated", says Prof. Dr.-Ing. Ulrich Nieken, Director of the Institute of Chemical Process Engineering (ICVT) at the University of Stuttgart.

### **Increasing the durability of turbine blades**

Third place winner, José Urbano from Leibniz University Hannover, dealt in his work assignment with aerodynamic stresses from turbomachinery blade vibrations. Very small, inevitable random variations in material composition and dimensions, resulting from the production process, together with the impact of external forces, resulting for example from the gas flow, may lead to very high vibration amplitudes and consequently to premature material failure. The FVV developed in a research project a simplified model approach, which should make it possible to identify critical vibration states of the blades already during the design phase of turbomachinery. Urbano's work assignment focussed on the extension of simulations taking into account the aeroelastic interaction of oscillating blades. "The study work represents a significant extension of a substructure-based modelling procedure and thus contributes to improve the simulative vibration prediction of mistuned turbine blades", explains Prof. Dr.-Ing. Jörg Wallaschek, Director of the Institute of Dynamics and Vibration Research (IDS) at Leibniz University Hannover.

### **Improving continuously the development of combustion engines**

The prize winning research projects are part of the German Industrial Collective Research (IGF) Programme. They were financed by the Deutsche Forschungsgemeinschaft (DFG, German Research Foundation) and the FVV's own research funds. Since 2006 the FVV has been awarding the Hans Dinger Prize every two years to three young scientists who have particularly contributed with their work to the success of IGF projects on the association's evolving research agenda. The prize recognises the scientific excellence of the work, its practical relevance and, in particular, the innovative character of the result of the research. The 2016 HDP Award was presented in Magdeburg on 29th September as part of the FVV Autumn Meeting. The prize commemorates the former CEO and CTO of the MTU. Hans Dinger (1927 to 2010) promoted the idea of industrial collective research all his life. From 1989 until his death he was Honorary President of the FVV.

## Images



1 | FVV Young Researchers Award 2016:  
1st Prize – Lukas Berger  
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2 | FVV Young Researchers Award 2016:  
The Winners and Jury Members  
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## About FVV

FVV | The Research Association for Combustion Engines is a globally unique network of companies, research & technology performers (RTD) and funding bodies. Manufacturers of automotive engines, industrial engines and turbomachinery as well as their suppliers and service providers work together with universities and other research establishments on cutting-edge technologies. The aim is to make engines and turbines cleaner, more efficient and sustainable – for the benefit of society, industry and the environment.

Combustion engines facilitate individual mobility, transportation, energy supply and industrial added value. The innovative power of the industry and its economic success make a significant contribution to social prosperity. As a non-profit organisation, the FVV supports the development of its members - small, medium and large companies - and the promotion of young scientists through pre-competitive industrial collective research.

The FVV is a member of the German Federation of Industrial Research Associations (Arbeitsgemeinschaft industrieller Forschungsvereinigungen - AiF), the leading national organisation for applied research and development for SMEs. It has invested more than 420 million euros in 1,200 research projects since it was founded in 1956.

More information at [www.fvv-net.de](http://www.fvv-net.de)