

FEV CHINA NEWSLETTER

FEV中国简讯

Technology Highlights and R&D Activities at FEV China
Issue 6, May 2015



Meet us at our FEV events
FEV技术研讨会, 期待您的加入

Upcoming Events from FEV 即将举办的FEV技术研讨会

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FEV Day of Powertrain China

Following the success of our former FEV Days of Powertrain in Dalian, we are proud to announce, that we will continue this series in 2015. With a fast-evolving automotive market in China and more stringent legislations, new technologies for fuel reduction and alternative fuel technologies are vital. At our FEV Day of Powertrain China, experts of the market and the FEV Group will be discussing solutions to address these issues.

Please save the date for our event:

Date: July 2nd, 2015

Venue: Hilton Shanghai Hongqiao Hotel,
1116 Hong Song East Road, Shanghai 201103.

FEV Virtual Engine Day China

FEV Virtual Engine as an industry-specific vertical application based on MSC Adams provides from project kick-off to start of production advanced mechanical dynamics solutions enabling lower cost, high quality powertrain development in shorter time.

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Preface



Dear readers,

The demand of reduced development and testing time in combination with the increase of powertrain and vehicle variants also in the Chinese market increase the necessity of local CAD/CAE activity expansion. Beside this increase of local "frontloading" activities an accelerated transmission and engine calibration using special software tools as well as testing on specialized test cells is more and more required.

In addition to our established activities in our Dalian headquarter we are fast expanding in parallel at Beijing as well as Shanghai to be as close as possible to our local clients. All three locations now offer complete CAD/CAE support as well as calibration activities. Central team managers are responsible for the use of similar tools and processes during the development process, china wide as well as in close cooperation with our German headquarter. The engine deep thermo-shock test benches, located at Dalian, are more and more used to accelerate the approval of new or updated engines under increased thermal stress. Some of those activities are described in this newsletter.

Sincerely Yours

Rolf Weinowski,
Chairman of the Board

亲爱的读者:

中国市场上动力总成和整车品种在不断的增加,同时又要求更短的开发周期和测试时间,扩展本地的CAD/CAE能力变得越来越重要。除了本地化先期设计开发业务的增长,使用特殊软件工具以加速变速箱和发动机的标定,并在专业试验台上进行测试,这样的需求也越来越多。

FEV除在大连总部已建立的能力外,同时我们也在快速扩展北京和上海分公司的业务,以尽可能贴近我们本地的客户以提供服务。目前以上三地均能为客户提供完整的CAD/CAE支持以及标定服务。主要团队经理将负责确保开发过程中所使用的开发工具及开发流程保持一致,并同时与FEV德国总部保持紧密合作。位于大连的发动机深度冷热冲击测试台架应用也同样日益频繁,用以在更高热应力下加速对新开发或升级开发的发动机的验证。

我们将在本期的简讯中讲述相关内容。

此致 罗尔夫·宛诺斯基 董事长

At our FEV Virtual Engine Day China, we offer the opportunity to meet our experts and other users to exchange your opinion and experience, and discover the capabilities of FEV Virtual Engine.

Please save the date for our event:

Date: July 3rd, 2015

Venue: Hilton Shanghai Hongqiao Hotel,
1116 Hong Song East Road, Shanghai 201103.

We are looking forward to meeting you at above exclusive events. For more information about these events, please get in contact with our colleague Mrs. Chen Yi (+8610 8492 3007 or via Email chen.yi@fev.com).

Please don't forget to register early, as these events are free of charge and the number of seats is limited.

FEV动力总成技术研讨会

基于FEV动力总成技术研讨会大连会议的成功,我们高兴地通知您,我们将于2015年继续举办此项盛会。随着中国汽车市场的快速发展和越来越严格的法规要求,降低油耗和使用替代燃料的新技术显得至关重要。在FEV动力总成技术研讨会上,我们将为您提供与FEV专家和行业专家分享、交流新技术的全新平台。把握本次机会,您将获得更多来自FEV关于如何应对中国市场、降低油耗的解决方案。

请保留我们的会议信息:

> 日期: 2015年7月2日

> 会议地址: 上海虹桥元一希尔顿酒店, 上海市闵行区红松东路1116号, 201103

FEV Virtual Engine技术研讨会

FEV Virtual Engine是基于MSC Adams的专业插件,提供从项目启动直至批产整个开发过程的先进动力学仿真解决方案,能实现以更低成本、更短的时间、更高的质量完成动力总成的开发。在FEV Virtual Engine技术研讨会上,我们将为您提供与FEV专家和其他用户共同交流的平台,分享经验、提升能力。

请保留我们的会议信息:

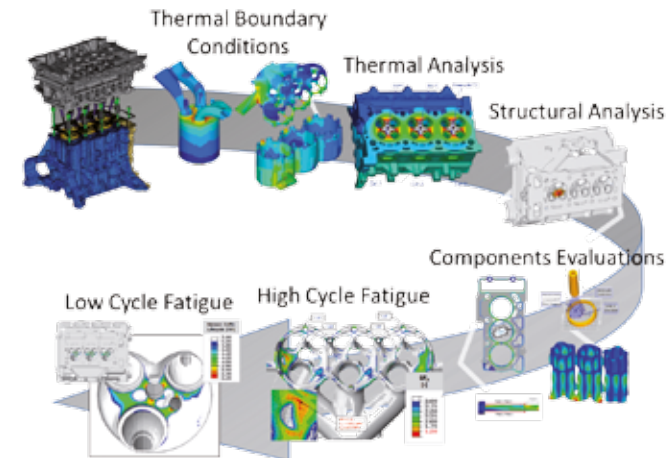
> 日期: 2015年7月3日

> 会议地址: 上海虹桥元一希尔顿酒店, 上海市闵行区红松东路1116号, 201103

我们期待您参与上述盛会,更多信息,请联系我们的同事陈怡女士(+8610 8492 3007 或电子邮件 chen.yi@fev.com)。本次会议不收取会务费,席位有限,先到先得。

FEM Mechanical Structure Analysis at FEV China

FEV中国的有限元结构仿真能力



Mechanical reliability analysis
机械可靠性分析

After the successful growth of local capacity in the CFD and MBS, FEV China has now further achieved the CAE ability in the FE Structure Analysis after more than one year of preparation. The FEA team is equipped with well experienced engineers and a technical specialist from FEV Germany. All engineers are trained in Germany through real project works until the German quality and efficiency is achieved. The working quality is further guaranteed by the FEV standardized methods. The technical capability is ensured and updated by the full support and shared database of the headquarter. With all the above efforts FEV is strengthening the China local capacity under the same requirement of process and standards, methods and tools, quality and efficiency. The local team brings further benefits for the customers in terms of cost reduction, work flexibility, and easy communication. As for example, standard structural analysis for mechanical is shown in the above picture.

继成功实现CFD和MBS的本地团队建设后,经过一年多的准备,FEV中国进一步完善了在有限元结构仿真(FEA)领域的CAE能力。目前,本地FEA团队具备经验丰富的工程师和一位从FEV德国来的技术专家。所有工程师均在FEV德国总部接受过结合实际项目的培训,独立进行FEA项目工作的质量和效率均与德国一致。本地CAE团队通过采用FEV标准化的分析方法来保障其工作质量,同时来自德国总部的全力支持和共享数据库也使得FEV中国CAE团队的技术能力得以保证和更新。通过努力,在要求相同的分析流程和标准、分析方法和工具、工作质量和效率的前提下,FEV正在加强中国本地CAE团队的能力。与此同时,FEV中国本地CAE团队将在降低成本、工作灵活性和方便交流等方面使客户直接受益。作为范例,在上图中展示了机械可靠性分析流程。

目前FEV中国所具备的有限元分析能力包括:

- > 温度场分析
- > 结构分析
- > 高周疲劳分析
- > 低周疲劳分析
- > 模态和动态应力分析
- > 结构优化

所能分析的发动机零部件包括:

- > 气缸盖
- > 气缸体
- > 前端罩盖
- > 附件支架
- > 连杆组
- > 排气歧管
- > 排气系统

更多信息,请联系姚玉武先生: yao@fev.com

The complete analysis tasks in FEV China include:

- > Temperature analysis
- > Structural analysis
- > High cycle fatigue analysis
- > Low cycle fatigue analysis
- > Modal and dynamic stress analysis
- > Structure optimization

The analyzed engine components cover:

- > Cylinder head
- > Engine block
- > Front cover
- > Bracket
- > Connecting rod
- > Exhaust manifold
- > Exhaust system

For more information, please contact Mr. Yuwu Yao: yao@fev.com.

One Dimensional Thermodynamic Performance Analysis 一维热力学仿真分析

As FEV China established a local CAE team, the ability which will be used to aim new engine layout development or existing engine performance improvement, one dimensional performance analysis is promoted well at FEV.

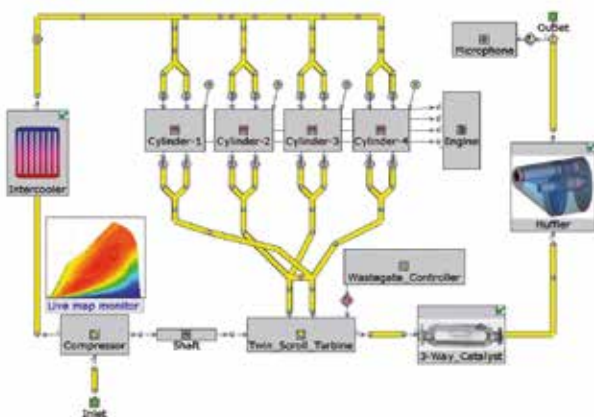
For all work scope, the same standards and software (GT-Power) as known from FEV headquarter are used. Relying on plenty of testing experience, FEV has extensive database and evaluation criteria, e.g. friction, combustion and port coefficient etc., ensure that more reliable simulation models and results can be provided. Experimental model approaches from FEV can help with different demands from customers. FE (Finite Elements) in GT-Power simulates temperature distribution in port and cylinder, predicts the engine thermal balance and heat rejection to water and oil. Usage of the simulation with regard to intake and exhaust system acoustic performance computes the noise propagating from the intake snorkel and exhaust tailpipe.

The local team will provide a more technical and valuable support to Chinese customers. Standard performance analysis model is shown in following picture.

Examples for the local supports include:

- > Intake manifold layout/modification
- > Valve timing and valve event layout/modification
- > Exhaust manifold layout/modification
- > TC pre-layout and matching
- > Cylinder pressure analysis
- > Thermal management in cylinder
- > Acoustic

For more information, please contact Mr. Yuwu Yao: yao@fev.com.



随着CAE团队在FEV中国的建立，现已具备良好的一维热力学仿真能力，用于辅助全新发动机项目开发与在产机型性能提升。

FEV中国的所有工作流程、标准及软件均与FEV德国总公司保持一致。依托于大量的发动机测试经验，FEV具有丰富的数据库和评价标准，例如，摩擦、燃烧和气道流量系数等，确保可以为客户提供更加可靠的仿真模型和结果。FEV有很多的经验建模方法，可以满足客户的不同需求。GT-Power中加入有限元，可以仿真气道和缸内的温度分布，预测发动机热平衡和对水、油的传热情况。对进排气系统线性声学性能的仿真，可以分析来自引气管和尾管的噪声传递。FEV中国的CAE团队会为中国客户提供更加专业、有价值的支持。在下图中展示了一维热力学仿真的模型。

目前FEV中国所具备的一维热力学分析能力包括:

- > 进气歧管设计及优化
- > 气门型线设计及优化
- > 排气歧管设计及优化
- > 涡轮增压器匹配、选型
- > 缸压分析
- > 发动机缸内温度场
- > 线性声学

更多信息，请联系姚玉武先生: yao@fev.com

1D thermodynamic performance simulation model
一维热力学仿真模型

Thermo Shock Systems and Thermo Shock Test Benches 热冲击系统及热冲击台架

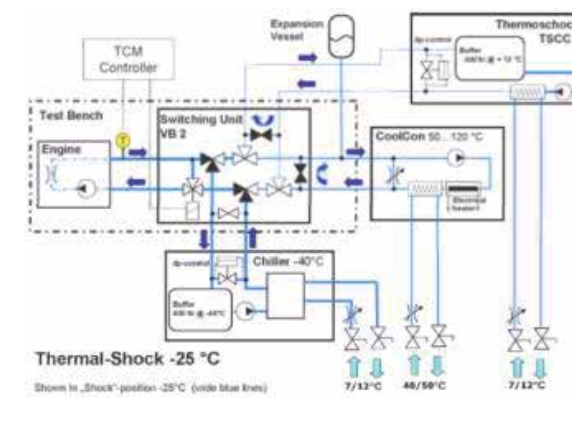


Fig. 1: Block diagram deep thermo shock
图1: 热冲击系统原理图



Fig. 2: Realized system at one of FEV's customers
图2: FEV为客户提供的实际系统

Engines need to work under a variety of temperature conditions. Some engine failure modes are caused by temperature cycling which in turn causes thermal expansion and contraction. This phenomenon can induce mechanical stresses which in extreme cases can lead to component failure. Especially for engines with combined materials those non-homogeneous contractions of the (e.g. cast iron) engine block and the (e.g. aluminum) cylinder head are often main root causes of failures of cylinder head gaskets which can lead to severe engine failures in the worst case.

More and more Chinese manufacturers are carrying out thermal shock tests in order to understand and prevent component failure, as well as to accelerate durability testing of engines and engine components, including cylinder-head gaskets.

Sure, a lifecycle of engines can be reproduced on a normal test bench also, but by the use of a thermo shock or a deep thermo shock system, testing times can be reduced significantly which over time leads to a higher test bench efficiency and a faster gathering of testing results which reduces development times of the engines.

FEV's thermo shock systems are developed according to our customer's needs with options for cooling as well as for heating where in both cases temperatures can be chosen in a wide range. We are also fulfilling your needs in the amount of stress that you would like to introduce into your engine by adjusting the flow rates of the hot or cold fluids.

The above pictures are showing examples of block diagrams of a thermo shock system and an actual system at one of our customers.

FEV can deliver both, stand-alone thermo shock systems, as well as fully equipped thermo shock test

benches and has already gathered a wide reputation on the Chinese market by finishing numerous projects to the customer's satisfaction.

For more information, please contact Mr. Veit Velten: velten@fev.com.

发动机需要在不同的温度条件下工作，一些发动机失效模式是因为温度循环而引起的热胀冷缩造成的，温度变化产生的机械应力在极端的情况下会导致零部件的损坏。特别对于采用多种材料的发动机，其缸体（如铸铁）和缸盖（如铝）材料的不均匀收缩是引起缸垫损坏的主要原因，缸垫的损坏在恶劣的情况下会引起严重发动机失效。越来越多的中国发动机生产厂商为了预防及查明零部件失效的原因，正在引入热冲击试验，并用以加速发动机和零部件，包括缸垫的耐久性试验的时间。

当然，发动机的寿命测试也可以在常规的发动机测试台架进行，但通过热冲击及深度热冲击试验，可以显著的缩短发动机的测试时间、提高台架的使用效率、快速收集试验数据从而减少发动机的研发时间。

FEV的热冲击系统是按照客户的要求进行设计的，具备冷却及加热的功能，在两种情况下客户可以在很大的范围内定义冲击温度。如果客户需要，我们也可以，通过调节进入发动机的热水或者冷水的流量来满足对应力的要求。

上面的图片是一个热冲击系统原理图和一个我们为客户提供的实际系统的照片。

FEV既可以提供单独的热冲击系统，也可以提供全套的热冲击台架，并且通过为国内客户提供大量的成功案例积累了丰富的经验。

更多信息，请联系Veit Velten先生: velten@fev.com

Exclusive Distribution of Tectos Products in China via FEV China 在中国市场独家代理Tectos轴系产品

For non-specialists test bench shafts may not be very exciting or even recognizable besides the more fancy other test bench equipment, surrounding them. Nevertheless the shafts which are connecting the test object (e.g. internal combustion engine, transmission or electrical engine) to the dyno or the braking system are high sophisticated pieces in the complete puzzle which are requiring a high level of technical understanding and engineering skills. For the Chinese market in the Austrian company Tectos FEV has found a reliable partner with more than ten years of special shaft development and manufacturing experience who has already solved numerous challenges at customers around the world.

It has shown that Tectos shafts or docking systems are proving multiple advantages compared to other systems on the market like maintenance friendly designs due to using only standard products (e.g. certain parts are interchangeable with one other) or very low weights of the couplings and shafts compared to competitors which significantly reduces stresses e.g. of the crank shaft bearings of the combustion engine or of the bearings of the dyno systems for longer life times and better test results. Additionally their shaft's designs supporting much shorter test bench set-up times. All those advantages are improving test bench utilization times and maximizing your profit.

Trusting and believing in Tectos ability to increase FEV's test bench performance FEV-China has become the exclusive distributor of Tectos products for the Chinese market.

If you are interested in high performance shafts for your test benches which are improving the quality of your test results, which are reducing the stresses on surrounding equipment and which are increasing

your test bench utilization we are happy to answer all your questions.

For more information, please contact Mr. Veit Velten: velten@fev.com.

相对于一些价格昂贵的台架测试设备，非专业化生产的传动轴并不引人注目。然而作为连接测试目标（内燃机、变速箱或者电机）与测功机或者制动系统的传动轴，在全部的环节之中是十分复杂的一部分，需要高水平的技术理解和设计加工能力。对于中国市场而言，FEV和奥地利的Tectos公司在特种传动轴的开发及生产方面已经有超过10年的合作经验，在全球范围内已经为无数的客户解决了他们无法处理的问题。相对于市场上的其它产品而言，Tectos的传动轴及对中系统有着多重的优点，因为采用了标准化生产设计（例如很多的零件可以互换），从而使维护更加方便，或者相比于同类产品，Tectos的轴及接头更轻便，从而可以明显减少了发动机曲轴轴承或者测功机系统轴承的应力，从而延长了这些轴承的使用寿命，同时也取得更精准的试验结果。所有的这些优势不但会提高台架的使用率，也会给您带来更大的效益。

正是因为相信了Tectos的能力，FEV的台架取得了很好的效果。FEV中国目前已经成为Tectos产品在中国市场的独家代理。

这种高效的传动轴产品会改善您的台架的测试结果，减少周边连接设备的应力从而提高台架的使用率，如果您感兴趣，我们很愿意和您做进一步的技术交流。

更多信息，请联系Veit Velten先生: velten@fev.com



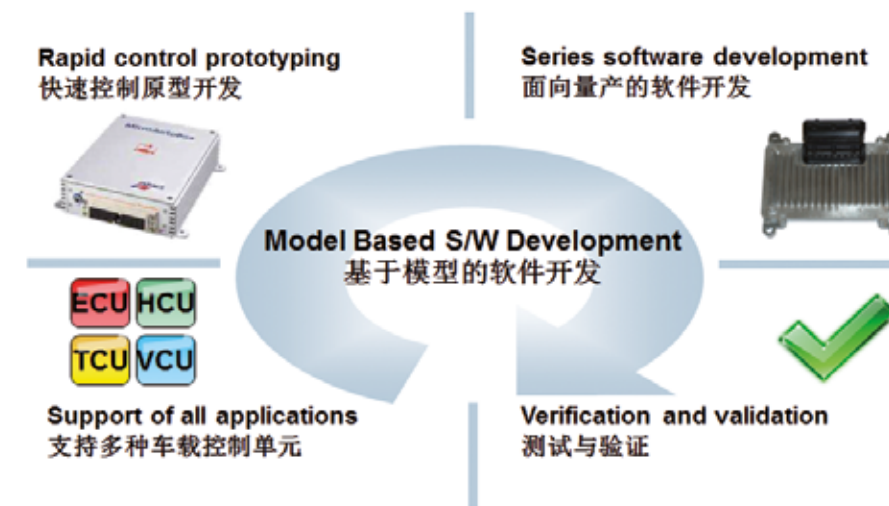
Fig. 1: Example picture Tectos products
图1: 部分Tectos产品的图片



Fig. 2: Example picture Tectos products
图2: 部分Tectos产品的图片

Local Capability Set-up: Software Development and xCU Calibrations

本土团队的建设：软件开发与控制单元标定



FEV model based software development
FEV基于模型的软件开发

To serve the huge Chinese automotive market in a better way, FEV is establishing its local capability also in the area of software development and xCU calibrations.

FEV can support our customer on software development in a full range from concept to SOP, which covers not only rapid control prototyping for demonstrator vehicles, but also automotive software for series production. In details, it includes the control concepts, software architecture, Model-based software development, automatic code generation, C-Code implementation and AUTOSAR compliant implementation, etc.

FEV's experience on calibration is also diversified in different areas of engine control, transmission control and hybrid control units. From one side it is customized and project specified. Flexible software solutions are provided to customers. And from the other side, FEV has established a professional and efficient method to standardize and shorten the calibration process, for example the internal developed software TOPexpert containing tools for automated calibration of different engine management functionalities like after start/warm-up enrichment, misfire diagnosis, cat diagnosis etc.

By setting up the local team, FEV will reinforce its service capability and efficiency in these areas for Chinese customers.

For more information, please contact Mr. Hengfei Jiang: Jiang.henfei@fev.com.

为了更好服务中国庞大的汽车市场，FEV正建立自身在软件开发和控制单元标定方面的本土能力。FEV可以为客户提供全套的从概念设计到SOP的软件开发服务，其不仅包含为展示车辆提供的快速模型的软件开发，也包括面向量产的软件产品开发。开发内容具体来说，涵盖了控制概念、软件架构、基于模型的软件开发、自动代码生产、C代码应用以及基于AUTOSAR架构的软件开发，等等。FEV在发动机控制单元、变速箱控制单元与混合动力控制单元上的标定经验也是多样的。一方面，FEV为客户提供灵活的标定方案，标定软件是针对具体客户和具体项目优化的；另一方面，FEV建立了一套专业而高效的方法来规范和缩短整个标定流程，比如内部开发的针对不同发动机管理功能模块（如启动阶段的加浓、失火诊断和催化器诊断等）的TOPexpert软件工具。通过建立本土团队，FEV必将加强对本土客户在这些方面的服务能力与效率。

更多信息，请联系蒋恒飞先生: Jiang.henfei@fev.com

5th Aachen Colloquium China Automobile and Engine Technology

第五届中国亚琛汽车和发动机技术年会



Impressions 2014
2014印象

From November 4th to 6th, 2015, the 5th Aachen Colloquium China Automobile and Engine Technology will take place in the Kempinski Hotel Beijing Lufthansa Center.

After the great success in 2014, more than 400 participants are expected to join this year's conference. It serves as a platform for discussions about latest developments and innovations in automobile and engine technology. The 5th Aachen Colloquium China again offers plenary speeches by high-ranking executives and chief engineers from the automotive industry as well as 40 international technical presentations. A technical exhibition of vehicle and engine manufacturers, suppliers and engineering consultants completes the program of conference. Furthermore, a Meet & Greet and a festive banquet offer numerous possibilities to get in touch with branch experts.

"Experts for the Chinese market meet experienced automotive engineers from all over the world—a great combination! The Aachen Colloquium China enables fruitful discussions to face the challenges in the automotive sector", Prof. Pischinger, CEO of FEV, states.

Additional information: www.aachen-colloquium-china.com

第五届中国亚琛汽车和发动机技术年会将于2015年11月4日至6日于北京燕莎中心凯宾斯基饭店举行。

2014年中国亚琛年会取得了巨大成功，预计今年将会有超过400人参加本次盛会。中国亚琛年会为探讨最新的汽车和发动机技术及创新成果提供交流平台。第五届中国亚琛年会将再次提供来自于汽车行业高级管理人员和首席工程师的主旨演讲，以及40场国际化技术演讲。同时，来自于汽车及发动机制造商、供应商以及工程咨询企业的技术展示，将使年会内容更加丰富完整。此外，欢迎酒会及主题宴会将提供更多与各领域专家交流的机会。

“中国市场的专家们将与来自全球各地富有经验的汽车行业专家们聚集一堂——这是一次伟大的融合！中国亚琛年会提供了这样的契机，使得专家们能够针对汽车行业所面临的挑战进行卓有成效的交流探讨” FEV首席执行官皮辛格教授如是说。

更多信息请参见：www.aachen-colloquium-china.com

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