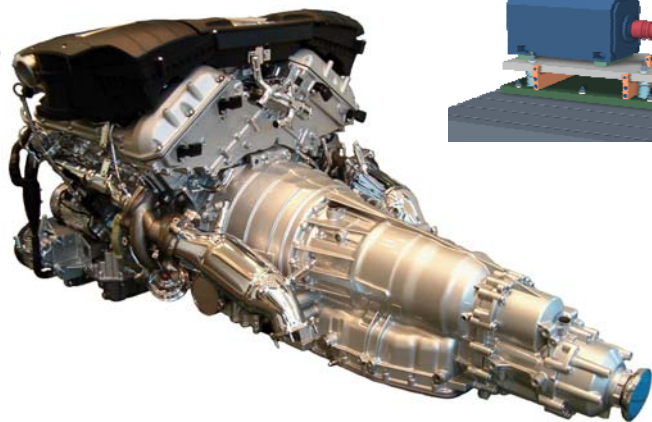
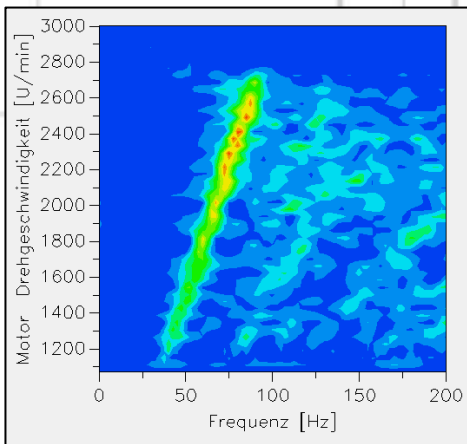


# *Simulation & Engineering*

*Computer Simulation & NVH Optimization of  
Drive Systems & Powertrains for the Automotive Industry*



**ARLA Maschinentechnik GmbH**

Hansestr. 2  
D-51688 Wipperfuerth / GERMANY

Internet: [www.arla.de](http://www.arla.de)

Tel: +49 2267 6585-0  
Fax: +49 2267 6585-70

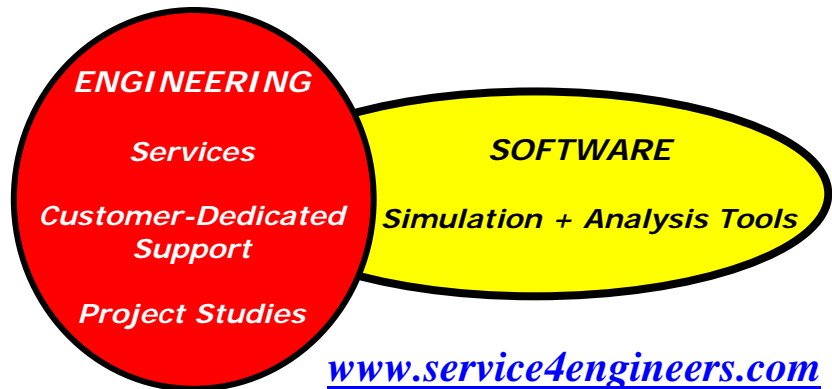
E-Mail: [info@arla.de](mailto:info@arla.de)



# Service For Engineers

## Computer Simulation & NVH Optimization of Drive Systems & Powertrains for the Automotive Industry

- Customer Engineering Services
- Application and Distribution of User-Friendly Simulation Software for PCs (Windows XP / Vista)

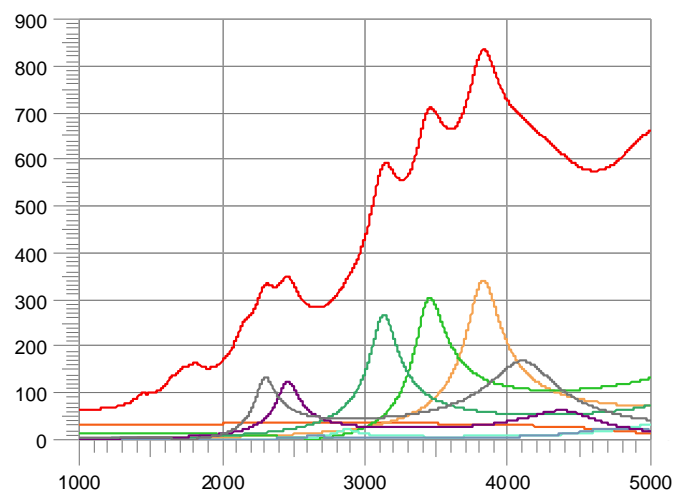
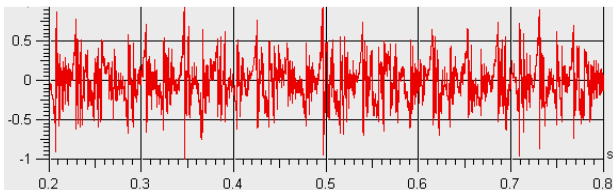


[www.service4engineers.com](http://www.service4engineers.com)

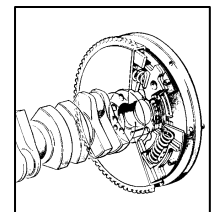
ARLA is specialist in PC simulation technology. Due to longterm experiences in the domain of the dynamics in drive systems and powertrains, ARLA offers a customer **SERVICE FOR ENGINEERS** worldwide including the professional consultation concerning the **NVH Optimization** (NVH = noise-vibration-harshness) and in general **DYNAMICS IN AUTOMOTIVE POWERTRAINS**. Due to a wide experience, especially concerning vehicle drive-lines (FWD, RWD, 4WD), **ARLA® Engineering Services** are offered and performed for more than 25 years. These services are realized using our own software packages on the one hand, and well-known software solutions like **SimulationX**, **ITI®-SIM** and **ARMD™** on the other hand. The close, partner-like cooperation to the software developers is an essential condition for the solution of the specific problems as well as the realization of the development objectives. Results and further information can be found in numerous publications, lectures, and books published by ARLA engineers.

The following typical **automotive engineering** topics are handled by the ARLA engineering specialists:

- **NVH Optimization:** analysis of the gear rattling phenomenon (with all backlashes in the gear stages), tip-in/tip-out (low frequency excitation), creeping, etc.; **NVH Sensitivity**
- Multi-parameter **Analysis of Excitability** (natural behavior), shiftability, synchronization
- Interdependences of engine & transmission (RWD, FWD, 4WD) → **System Analysis**
- Steady-state simulation for optimum **Absorber & Damper Design** (crankshaft, pulley, gears)
- Special analysis considering integrated **Starter-Alternator-Damper-Systems**

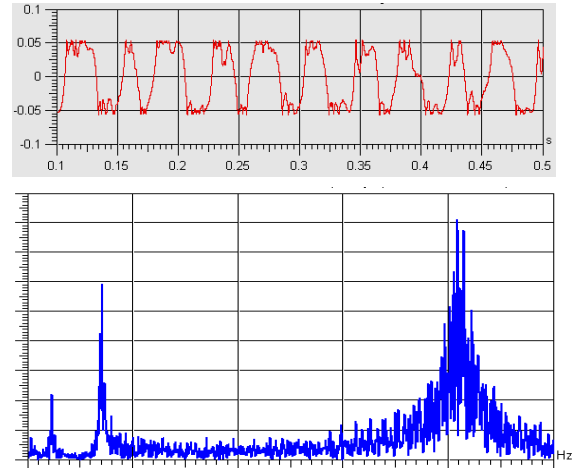
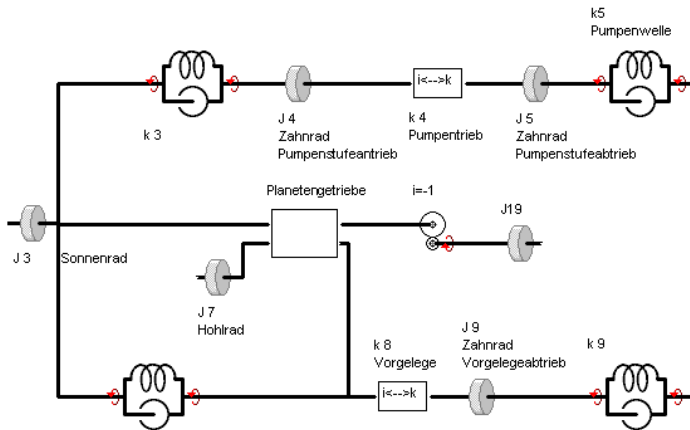


- Considering typical non-linear effects (clutch, joint discs, dampers, DMF=dual-mass-flywheel, angle or velocity dependent elasticities, dampers and friction elements); special applications to optimize a dual-clutch-transmission (DCT). **Load-Studies** (Run-Up, Slow-Down), **Sensitivity-Studies** (backlash).
- **Detail-Studies of Gearstages/Transmissions:** CVT, differential gears, planetary gears, dual-clutch transmission (DCT), different driveline concepts (RWD / FWD / 4WD / AWD) for passenger cars and also commercial vehicles under specific drive scenarios





- Overall engine analysis with all **Auxiliary Drives**; special analysis of test rig design
- **Simulation of the Road/Wheel-Contact** using slip characteristics
- special **Models for Fired and Non-fired Test Rigs** for engines
- Simulation engines including a **Crankshaft Starter Generator (ISG)**
- customer-specific **Solutions** as well as **Support of Mechanical Engineering Tasks** for the development and design of test rigs

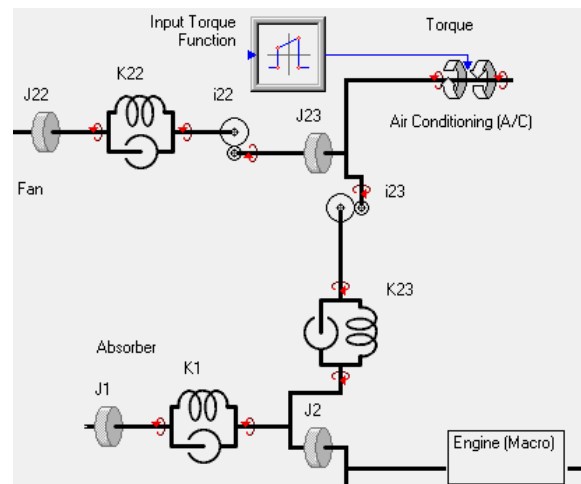


In order to meet all customer's requirements (**ARLA Engineering Service**), ARLA uses and distributes high-sophisticated simulation software packages like **ITI<sup>®</sup>-SIM**, **SimulationX** and **ARMD<sup>™</sup>**. ARLA is also usually present at international conferences like (ASME, SAE, IMechE, VDI, Haus der Technik, ARLA-Seminars).

## ARLA's high-sophisticated Engineering Service ...

- **Simulation in the Time- / Frequency Domain** using **ITI<sup>®</sup>-SIM + ITI<sup>®</sup>-STAT + SimulationX**

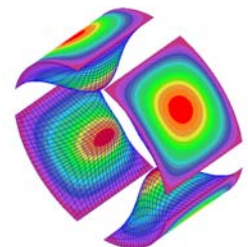
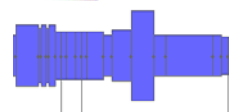
- Mechanics (motors, engines, couplings, clutches, transmissions, cardan shafts, etc.)
- Control Engineering
- Hydraulics
- Pneumatics
- Thermics
- Special Customer Support using ARLA<sup>®</sup>-Tools
- Professional Engineering Service for R&D
- Special ARLA Model Generation Strategies for NVH Studies



- **Rotordynamics & Bearing Analysis** using **ARMD<sup>™</sup>**

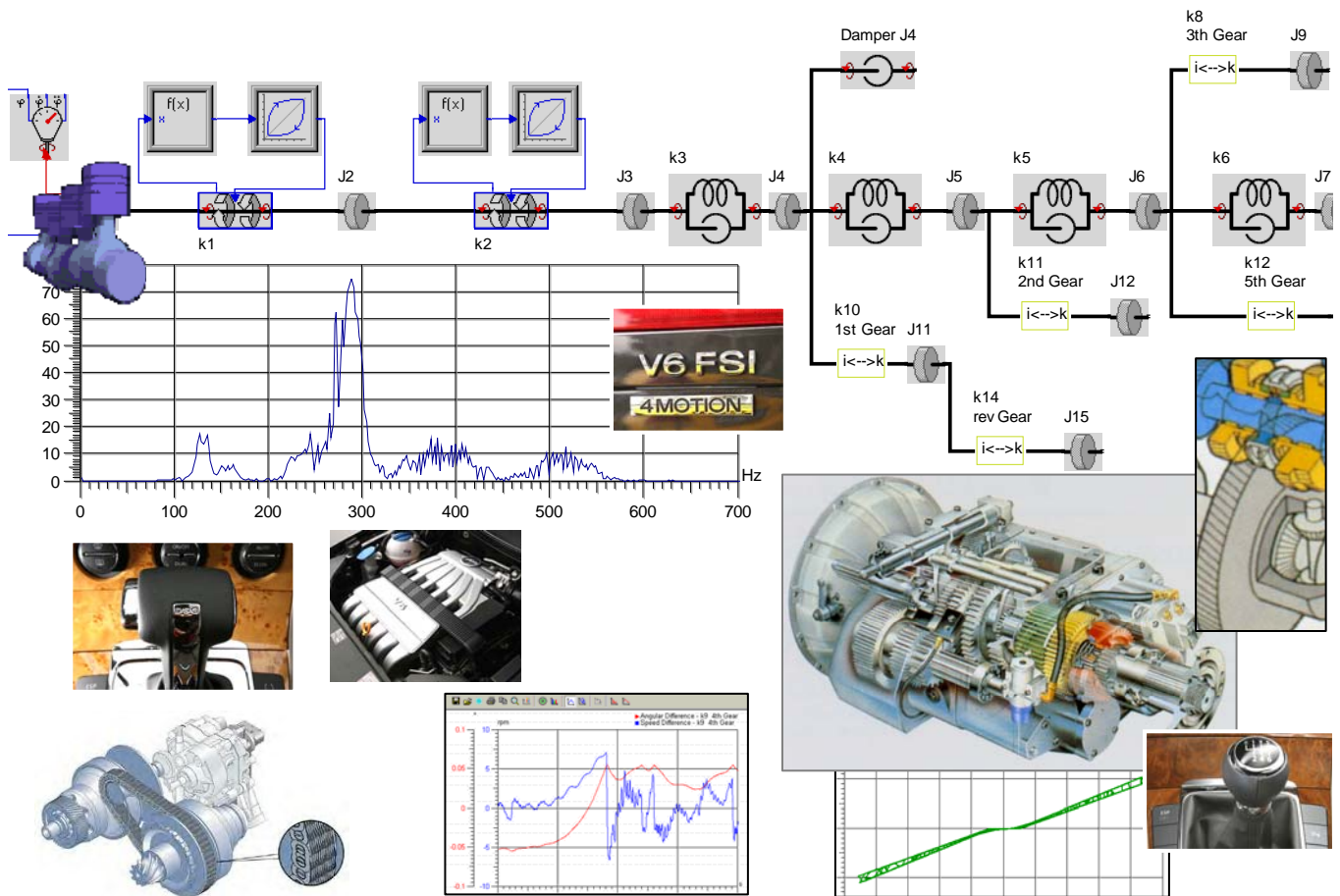
- Lateral / Torsional Vibration Analysis (stability analysis, critical speed map, response curves)
- Analysis of Rolling Element & Fluid Film Bearings
- Engineering Service and Special Studies

International Seminar:  
**ROTOR DYNAMICS & BEARINGS**  
October 18-21, 2010  
COLOGNE (Germany)



Whether engineering services "on call" or working out new product concepts:

Use our **ARLA Engineering Services** as "extended engineering work bench" ...  
... a worldwide engineering service with high quality and more than 25 years experience !



## Special publications concerning vehicle drivelines (extract)

- [1] **Laschet, A.:**  
Computer simulation of vibrations in vehicle powertrains considering nonlinear effects in clutches and manual transmissions.  
SAE Paper No. 941011, Detroit 1994
- [2] **Fan, J.; Laschet, A.:**  
Messtechnische Methoden und Anwendung der Computer-Simulation zur Minimierung von Getriebegeräuschen  
VDI Conference "Getriebe in Fahrzeugen '95". VDI-Report No. 1175. Düsseldorf: VDI-Verlag 1995
- [3] **Fan, J.; Hierlwimmer, P.; Laschet, A.:**  
Investigation of Gear Rattle Sensitivity on Manual Transmissions in the Target Setting Process  
ATZ Automobiltechnische Zeitschrift 99 (1997) 5, pp. 9-11 (Appendix)
- [4] **Laschet, A. and co-authors:**  
**Systemanalyse in der Kfz-Antriebstechnik I**, Haus der Technik - Fachbuch, Vol. 6 (book of the 1<sup>st</sup> and 2<sup>nd</sup> conference)  
Renningen: Expert-Verlag 2001 (ISBN 978-3-8169-1938-4)
- [5] **Laschet, A.; Fan, J.:**  
NVH-Systemattribute vom Antriebsstrang: Zielkonflikte und Lösungsmöglichkeiten  
from: Conference book of 10<sup>th</sup> Aachen Colloquium Vehicle & Engines, pp. 615-630, Aachen 2001
- [6] **Laschet, A. and co-authors:**  
**Systemanalyse in der Kfz-Antriebstechnik II**, Haus der Technik - Fachbuch, Vol. 22 (book of the 3<sup>rd</sup> and 4<sup>th</sup> conference)  
Renningen: Expert-Verlag 2003 (ISBN 978-3-8169-2201-8)
- [7] **Laschet, A.; Fan, J.:**  
Ermittlung der NVH-Sensitivität durch geeignete CAE-Modellierung  
from: Conference book of 12<sup>th</sup> Aachen Colloquium Vehicle & Engines, pp. 719-733, Aachen 2003
- [8] **Laschet, A. and co-authors:**  
**Systemanalyse in der Kfz-Antriebstechnik III**, Haus der Technik - Fachbuch, Vol. 44 (book of the 5<sup>th</sup> conference)  
Renningen: Expert-Verlag 2005 (ISBN 978-3-8169-2479-1)
- [9] **Laschet, A. and co-authors:**  
**Systemanalyse in der Kfz-Antriebstechnik IV**, Haus der Technik - Fachbuch, Vol. 79 (book of the 6<sup>th</sup> conference)  
Renningen: Expert-Verlag 2007 (ISBN 978-3-8169-2686-3)
- [10] **Laschet, A. and co-authors:**  
**Systemanalyse in der Kfz-Antriebstechnik V**, Haus der Technik - Fachbuch, Vol. 100 (book of the 7<sup>th</sup> conference)  
Renningen: Expert-Verlag 2009 (ISBN 978-3-8169-2844-7)

## ARLA Maschinentechnik GmbH

Hansestr. 2  
D-51688 Wipperfurth

Internet: [www.arla.de](http://www.arla.de)

Tel: +49 2267 6585-0  
Fax: +49 2267 6585-70

E-Mail: [info@arla.de](mailto:info@arla.de)

