VMC® – GeoLDA

Geo-referenced Load Data Analysis for Vehicle Engineering

The objective of VMC GeoLDA (Virtual Measurement Campaign – Geo-referenced Load Data Analysis) is to enrich measurement data collected on public roads in order to gain additional information for the vehicle development process.

Therefore, the measured time series data is mapped to the corresponding digital road segments (map matching). Thus, it is possible to assign properties of the road segments to the segments of the measurement data.

With VMC GeoLDA, the data is automatically cut into segments according to the operating conditions and the appropriate load data analysis (Rainflow and pseudo-damage calculation) is carried out for each segment.

VMC GeoLDA supports the user to process extensive measurement data in a fast, efficient, and transparent way. It provides a useful extension to classical LDA software. In addition, VMC GeoLDA helps to improve the documentation of results and decisions.

Use Cases

Typical applications in vehicle development (passenger cars, VANs, trucks) are:
- Durability and reliability in the development of suspension, chassis, vehicle body, engine, gearbox, drive train, etc.
- Energy efficiency in the development of the engine, powertrain and exhaust systems
- Studying customer behavior with respect to typical driving cycles (fleet data, selected customers, etc.)
**Benefits of VMC GeoLDA**

- **Support and improve the planning of real physical measurement campaigns** by analyzing the planned routes with respect to relevant environment factors such as road type or topography.
- **Saving resources** by focusing on covering all operating states of interest (factor level combinations) in a measurement campaign without having to be representative for a particular type of customer.
- **Efficient, accurate and automatic processing** of large measurement datasets.
- **Statistical analyses** of the results, e.g. how large is the influence of the factor road type or hilliness on the durability or consumption.
- **Extrapolating** the data provided by VMC GeoLDA to different **target markets** using appropriately adapted **usage models** (e.g. customer simulation with U-Sim).
- **VMC GeoLDA** is available in two different configurations depending on the customer's requirements (standalone version without GUI and database connection or fully integrated VMC module).

**Database**

VMC GeoLDA provides map data for the whole world separated into seven predefined regions (Eastern Europe, Western Europe, North and Central America, South America, Asia, Africa, Australia).

The map data is provided file based in contrast to the database solution of the VMC software suite. The customer can choose the regions he wants to purchase.

**VMC Simulation and Related Activities**

The department **Mathematical Methods in Dynamics and Durability** at Fraunhofer ITWM is active in modeling and simulation of usage variability, dynamic loading and energy efficiency of vehicles and machines. We are developing statistical methods for durability, reliability and energy efficiency.

Our software development projects **Virtual Measurement Campaign (VMC)**, **Usage Simulation (U-Sim)** and **Statistics for Fatigue Testing and Reliability (Jurojin)** combine statistical and simulation methods with geo-referenced data in a unique novel way. These tools support the entire process from the description and modeling of the usage variability, the derivation of reference loads and consumption related quantities to the design of rig tests or reference routes. **VMC GeoStatistics** is an important part within these activities.

**Main features of VMC GeoLDA**

- Mapping of the route onto the digital road network using the GPS signal and the VMC road database
- Segmentation according to the different road types, including the differentiation between urban and rural roads
- Classification of the road segments
- Visualization and evaluation of map matching results
- Rainflow analysis and pseudo-damage calculation for the segmented time series data
- Calculation of further quantities (for example consumption) on request
- Numerous data export functions

**Measurement data requirements**

- Map matching requires the GPS coordinates (latitude and longitude)
- GPS signal needs to be synchronized with the other time series data
- Supported data formats:
  - Diadem, KML, GPX, MAT, MDF

**System requirements**

- Windows 7 64-Bit or later
- 4GB RAM or more
- Microsoft Excel 2010 or later
- Up to 200GB HDD for map data
- PostgreSQL database server with at least 2TB storage (database and workspace)