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RailBit® Synopsis

RailBit® is a software for the microscopic simulation of railway traffic networks based on detailed modelling of the railway infrastructure, technologies and signalling system, rolling stock and power line.

The modelling framework at the basis of RailBit® has been developed within two research projects, FERSAT¹ and TESYS RAIL² (partners: Ansaldo STS, RFI, Politecnico di Milano, University of Florence, etc.), and has been conceived to overcome the limits of existing commercial microscopic simulation software, such as OpenTrack or RailSys. Limits that reduce simulation accuracy or prevent the use of simulators for the evaluation of technological innovations of the railway system. See for example the evaluations of the impact on operations of the introduction of new telecommunication and satellite tracking technologies, in ETCS level 2 or 3 systems, or that of energy saving technologies and strategies (main objectives of the two projects mentioned).

Main innovative features of RailBit® are:

- Consistency of all models (e.g. train, signalling, infrastructure) with the ERTMS specification - ETCS Baseline 3 (Subset 026);
- Calculation of the braking curve by numerical integration of the dynamic equation of motion (i.e. with resistances and braking effort), according to ERA ERTMS Baseline 2;
- Explicit emulation of the performance of signalling and train control systems, enabling the simulation of real operation of ETCS signalling system. For example: communication delays, on-board computer processing times, (physical and virtual) balises positioning errors;
- Modelling of energy line and interactions with train operations;
- ATO with eco-driving;

Advanced analysis tools and functions available in the software:

- Module for consistency analysis between infrastructure (including energy line), rolling stock, signalling system, and timetable;

¹ FERSAT - studio di un sistema di segnalamento FERroviario basato sull'innovativo utilizzo delle tecnologie SATellitari e della loro integrazione con le tecnologie terrestri (PON03PE_00159_4)

² TESYS RAIL - Tecniche e strumenti per incrementare la sostenibilità ambientale dei sistemi di trasporto ferroviari (CTN 01_00176_166167)

Inputspace S.r.l.

www.inputspace.xyz

Sede legale

Piazza dei Martiri 30, 80121 Napoli (NA), Italy | T: 0817642888

Sede operativa

Via Claudio 21, 80125 Napoli (NA), Italy | T: 0817683770

P.IVA e C.F.

08403961215



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- Automated conflict management in interlocking areas (through customizable priority, delay and waiting strategies) and in single-track sections (through anti-deadlock strategies);
- Design and verification module of energy-saving driving strategies;
- Verification of energy loads in substations during simulation;
- Module for quasi-Monte Carlo simulations and global output sensitivity analysis (GSA), for various purposes. For example:
 - Stress testing of the railway system under non-nominal conditions;
 - Probabilistic analyses of system performance (e.g., delays, capacity) and quantification of contributing factors (GSA);
 - Robust design of infrastructure or signalling system, and operation (timetable).
- Tool for automatic generation of block sections by explicit enumeration of k -minimum paths (in other software the definition of thousands of block sections in a network is usually manual);
- Automatic timetable design module using microsimulation;
- Parser of the OpenTrack infrastructure, rolling stock and signalling data model using RailML data format.

The software is available in a prototype version in Matlab. A Java version is under development.

Non-exhaustive list of possible applications of the software:

- Planning & assessment
 - Signalling system design and verification
 - Timetable design and validation (stability analysis)
 - Network performance evaluation (e.g. capacity, delay, punctuality)
 - Design and optimization of energy recovery systems (including eco-driving)
- Real-time traffic management
 - Rescheduling and rerouting
 - Service disruption management

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