CECUBE LTD.

Traction Model List

SIMULATION COMPONENTS CATALOGUE

The following modules are members of the software component catalogue. To be included in the catalogue the latest revision of the component must have undergone software testing, and wherever possible comparison made with measured results. The components are designed around coding guidelines, which permit a hierarchy of components to be combined into a single project directory, and compiled without redesign.

POWER CIRCUIT COMPONENTS

Substation – 6 or 12 pulse substation rectifiers
OHLE - AC supply catenary model permitting 1, 2 or 4 pi sections, good for 0-20km from feeder station operation
Transformer - Models magnetising circuit of main transformer with settable remanent flux and voltage phase point at start and track circuit representations
Converter - Detailed 4 quadrant converter circuit, includes AC side filters
Bridge – Thyristor bridge front end with power factor correction
DCLink – DC link with 100Hz filtering for converter or bridge rectifier front-ends
Load - Resistive or constant power type load with parallel choppers for braking or overvoltage limiting
Choppers - Model of GTO line choppers
Motor Choppers - Model of GTO motor choppers
Chopper - Rheostatic brake resistor chopper with active compensation
Inverter - Decodes PWM switching state into 3 phase inverter output voltage
IGBT - Model V-I law of IGBT 1700V for inclusion in inverter model (Siemens BSM 150 GB 170 DN2)
Chopper LRV - Combined Armature and Field GTO choppers
Step-up chop - Front end DC chopper/AC converter with control and waveform generation
Step-up chop power circuit - Passive power circuit for use with DC/AC front end
Dev_Equation - V-I equations for DG758BX45 GTO and CXC624 anti-parallel diode
Conv_loss – Converter power device loss determination
Inv_loss - Inverter power device loss determination

MACHINE COMPONENTS

Motor DC - DC motor model used in series field mode, with field divert
Motor Sep-ex - DC motor model used in Separately Excited configuration
Motor - AC induction motor dq model
2 AC motors - 2 parallel motor modelled individually to permit use of differing parameters
Alternator - Field controlled induction alternator - behavioural model with rectified output

WAVEFORM GENERATION COMPONENTS

RSPWM - Choice of symmetric or asymmetric versions of regular sampled PWM
NatPWM - Natural sampled PWM based on analogue hardware triangular comparison
EPWM - An alternative strategy to RSPWM for 4Q converters
OPWM – Wave generator with optimised switching angle calculation
Asynch - PWM asynchronous mode generator for 3 phase inverters
Modeselect - PWM mode selector for 3 phase inverters
MA818PWM - Double edge RSPWM simulation with 3rd harmonic addition

CONTROL COMPONENTS

Control AC – 4Q-converter controller including timer and d/a accuracy effects
Bridge Control – Controller for single or series thyristor bridges
Phase Lock - Produces a pure version of the supply voltage with the phase lag cancelled out by resetting the phase at each zero crossing
Control DC - Line chopper and battery supply control for DC system
Motor Control - Motor chopper control system with pulse width outputs
Scalar - Inverter scalar torque controller
Vector – Inverter vector torque controller
Control LRV - DC motor control by armature current at low speed, field current in weak field
Control DC6 - Independent control of six, parallel DC motor armatures by field control

MECHANICAL COMPONENTS

Mechanics A - Axle hung motor arrangement and suspension modes
Mechanics F - Frame mounted arrangement and suspension modes
B2B mech – 2 mechanically coupled back to back motors
Coupler – Inter-car coupler model
Adhesion - Programmable wheel-rail adhesion characteristic
Railjoint - Models vertical wheel velocity variation at rail joint
Train Load – this comprises the train mass, that of the passengers, train air resistance characteristic, and gradient
Quill tube - Loco gearbox/quill tube & mechanics
Mono Trans - Mono motor transmission drive
Diff gear 1 - Detailed model of differential gear drive for articulated tram. Includes modelling of ring and differential gears
Diff gear 2 - As above, but a behavioural model of differential gears producing results very similar to above, but requiring less detailed knowledge of gear parameters

BRAKE COMPONENTS

Master - Master Controller (driver handle) creating the BE demand
Frame - Brake Control Frame (failsafe inversion and brake pipe pressure restriction for wheel cylinder)
BBV - Brake Blending Valve (continuously variable on motor cars, while simpler open/closed type used on the trailer car)
Loadweigh - Load Weight Valve
Dump - Hold and release Dump Valves for Wheel Slide Protection (air system)
BE Elec - Electrical Brake Effort system including slide correction
Brake interface - Interfaces between electric and pneumatic system
Speed - Speed transducer slide (electric) detection system

ANALYSIS COMPONENTS

Spectrum - windowing FFT based spectral and power factor analyser with programmable anti-alias filters
Spectra - Spectral analyser developed to study EPWM
DFT - Spectral analysis geared to BR 1914 infrastructure and track circuit criteria
TC_DC - DC track circuit model on single, double, or multiple booster transformer or rail return track section with crossbonds, train length, structure earthing and ballast effects
TC_50 – 50Hz track circuit model on single or double track for DC electrified railways
TC_reed – An electrical model of the electro-mechanical characteristics of a reed track circuit relay
Wpsoph - Psophometic weighting curve for telephony compatibility