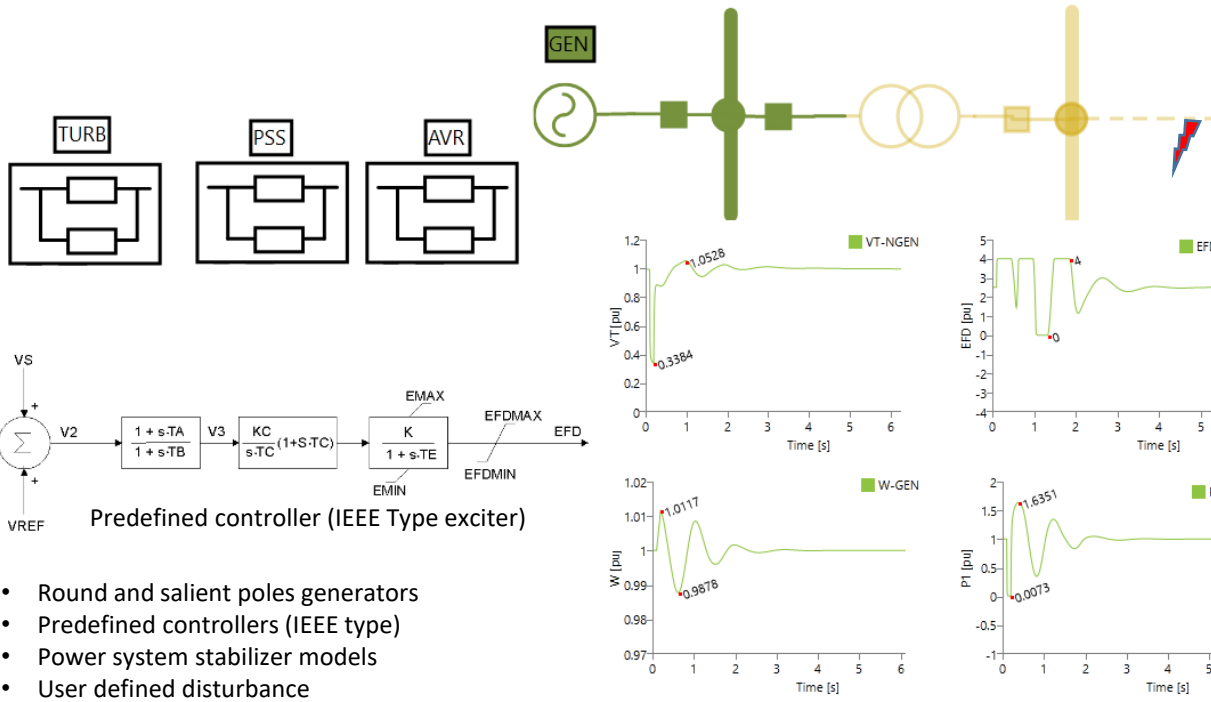
Dynamic Analysis

This module performs the electromechanical (RMS) and electromagnetic transient studies (EMT) to analyze the dynamic behavior of the power system under various operating conditions and system disturbances. It can be used in balanced/unbalanced for AC and DC networks. The dynamic module has fast and robust solver being able to solve very large-scale network with high performances in terms of numerical stability, accuracy and resolution time.

The NREPLAN built-in library has an extensive predefined controllers (EEE, IEC and CIRED standards), which make it a handy tool for quick and effective modelling of your system.

The NEPLAN Dynamic Simulator implements a unique mathematical framework for nonlinear system with fast/slow continuous and discrete (hybrid) systems. The automatic and sophisticated built-in initialization algorithms avoid struggling with any kind of initialization problems.



Predefined controller (IEEE Type exciter)

- Round and salient poles generators
- Predefined controllers (IEEE type)
- Power system stabilizer models
- User defined disturbance
- Results visualization (plots, graphs)

Solution with dynamic using NEPLAN

RMS-DQ0

- Assessment of dynamic security of balanced power grid
- Rotor angle response to a transient disturbance
- Assessment of dynamic behavior of AC Disperse generators (Grid Code)
- Model validation (Fine- tuning parameters)

RMS-ABC

- Multiphase transient stability is necessary for the following situations:
- Asymetrical faults
- Asymmetrical network topology
- Unbalanced loading
- Single-Pole tripping and reclosing

EMT-ABC

- Temporary overvoltages
- Load rejection
- Ground fault
- Transient Switching overvoltages (e.g line energization)
- Transformer/capacitor/filter-energization (inrush current)
- Ferroresonnance
- Sub-synchrnous resonance

NEPLAN®
Smarter Tools

Modelling capabilities

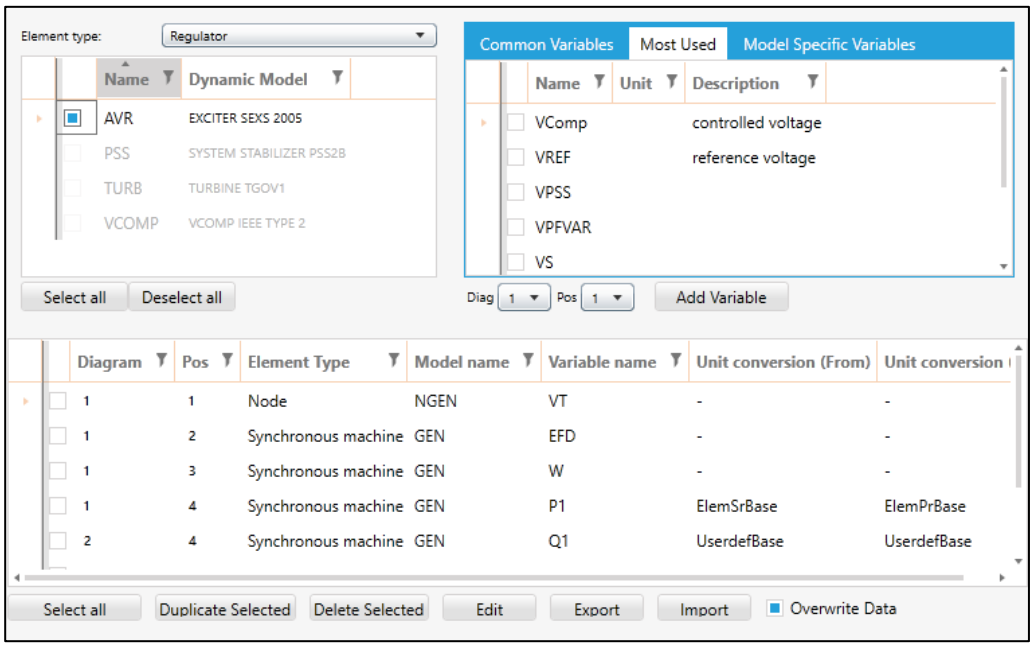
- Synchronous machine round rotor and salient models (Transient and Sub-transient models with saturation)
- Extensive library with predefined regulators (IEEE/IEC standard) including: Automatic Voltage Regulator(AVR), Power system stabilizer(PSS), Turbine/Governor and Under/Over Excitation limiters
- Induction motor models (First, Third and fifth order) with various mechanical load models
- Direct on-line or assisted induction motor starting with various start-up methods
- Black-start for synchronous generator
- Detailed modelling of Doubly Fed Induction machine
- Detailed modelling of DC battery for Storage Energy
- Comprehensive modelling of DC Photovoltaic (PV array) with user-defined solar irradiation variation
- Comprehensive modelling of HVDC with rectifier and inverter control
- Accurate representation of Power-electronic-based devices (e.g. PWM)
- Flexible AC Transmission Systems with their associated dynamic controls (e.g. SVC,UPFC)
- Generic dynamic models with a comprehensive structure for Wind turbines (IEC 61400-27-1standards)
- Generic dynamic models for Photovoltaic (CIRED standards)
- User-Defined modelling approach for regulators, elements and protection devices using either :
  - Graphical Editor: Drag and drop of the function blocks in NEPLAN editor
  - SYMDEF : This approach is based on the premise of solving the user-defined equations created with simple text editor. The modelling flexibility of this approach is suitable to build control diagram with complex logic .
- Modelling of wide area network controller using Generic regulator (e.g. Centralized controller for Microgrid, Automatic Generation Control (AGC))
- Predefined protection devices with the desired action/event (load shedding, load adding, generator start-up, switching in/out elements, increase/decrease setting point of load or generator, etc.)
  - overcurrent relay (50/51 P/N) and Fuses
  - Distance relay (21 P/G)
  - Frequency relay (81O/81U/81R)
  - Under/Over-Voltage relay (27/59)
  - Pole slip and power relay
- User defined protections described by equations or function blocks

Calculation features

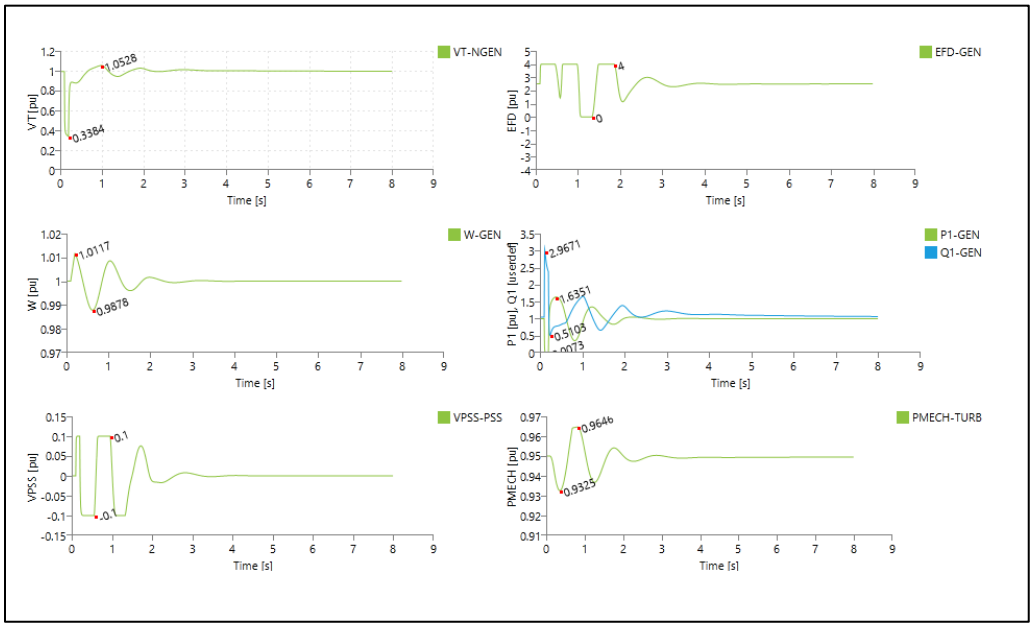
- Dynamic simulation type:
  - RMS (Transient Stability simulation), in DQ0 and ABC reference frame
  - EMT (Electromagnetic Transient simulation), in DQ0 and ABC reference frame
- Computation methods:
  - Fixed step based on trapezoidal integration method
  - Variable step integration method with adaptative step size
- Automatic initialization procedure for state variables and reference setting points of regulators
- Powerful convergence control with an advanced event detection
- Ability to solve the problem with multiple processors using parallel computation technique.
- Create passive network for passive elements to speed-up the simulation for large scale network.
- Definition of different faults (symmetrical and unsymmetrical) on buses and branches.
- Disturbances with function activation (step, ramp, sinusoidal function or combination)
- Disturbance with different switching operations (in/out of branches)
- Disturbance with model parameters change during simulation
- Disturbance specific to Grid code assessment : Application of a specific voltage profile (LVRT/OVRT)
- User-defined disturbances (every variable can be modified in the network/control)
- Possibility of defining and saving various disturbance groups, with different single event per case)
- Control of simulation time using "Stop Condition“
- Possibility to disable the protection devices during simulation
- Run consecutive simulations for all the event group

Results

- Advance screen plot features for the displayed variables
- The user has the possibility to define up to 6 different diagrams and 6 subplots for each diagram
- NEPLAN offers the possibility to display the variables with the appropriate unit using the unit conversion tool
- The results can be stored and saved for later processing in different formats (Excel,csv,XML,Comtrade)



Add Variable: selected variable window



Screen plots: definition of the variables to be displayed or stored