

DYNRED™

DYNRED (DYNamic REDuction) was a software program developed by EPRI in 1990s for creating dynamically equivalenced models of large power systems. DYNRED has been used by utilities in various capacities.

Recently, DYNRED was undergone a major overhaul sponsored by EPRI, supported by several large ISO/utilities, and completed by Powertech. The enhancements are mainly made in three areas:

- Making the models and data compatible with databases currently used by industry.
- Implementing a user-friendly software interface.
- Adding tools to compute performance indices for validation of reduced models.

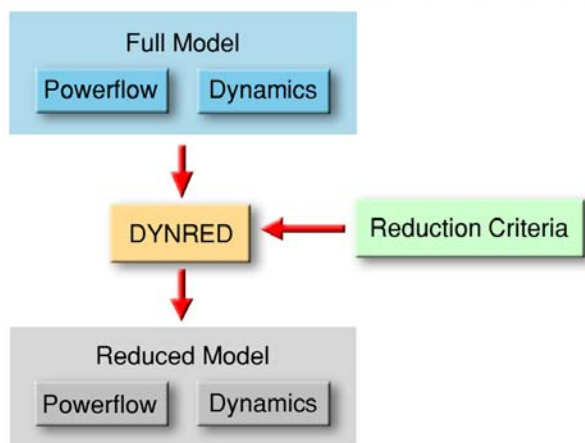
The latest version of DYNRED is being commercialized and supported by Powertech.

Application Scope

DYNRED starts with a set of models for a power system: powerflow and dynamics. For a specified set of system reduction criteria, DYNRED reduces the system in the external region by replacing it with static and dynamic equivalents. The result is a smaller system model that allows fast computations for system performance analysis.

DYNRED can be used for various applications, including:

- Development of base models for system planning.
- Building models for on-line dynamic security assessment.
- Construction of appropriate models for control system design and tuning.



Product Features

- **Reduction of large power system models for static and dynamic performance analysis**
- **Choice of reduction algorithms**
- **Compatibility in data formats with industry practices**
- **Performance benchmarking tools for reduced model validation**
- **Graphical user interface**

Reduction Criteria and Methods

To achieve the required reduction objectives, a set of criteria and methods can be specified:

- Regions of the system to be retained and to be reduced ("retained system specification").
- Grouping of generators in the external region ("coherency identification"). Choices can go from the simple weak link method to more advanced tolerance-based method.
- Handling of the coherent generators in the system ("generator aggregation"). Either classical or hybrid method can be used.

Model Validation

A reduced model created can be validated by using the performance metrics computed by DYNRED from various types of applications, including:

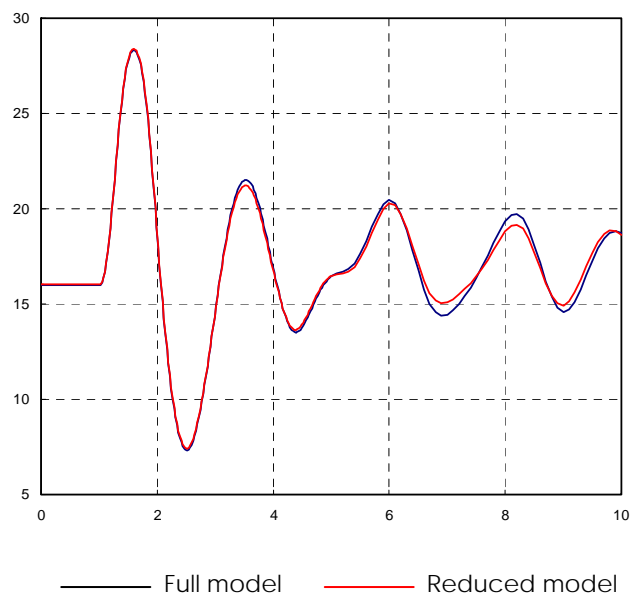
- Basic powerflow performance.
- Extended powerflow performance at post-contingency conditions.
- Time-domain performance from nofault simulations and simulations for specified contingencies.
- Frequency-domain performance from comparison of dominant modes in the system.
- Stability limit comparison subject to voltage and transient criteria.

Application Example

This example shows a dynamic reduction done using DYNRED for a large power system model. The following table gives the details on the full and reduced models.

	# of Buses	# of Generators
Full model	54,735	7,887
Reduced model	25,941	3,099
Reduction ratio	47.4%	39.3%

Using the reduced model, the time it takes to complete a typical time-domain simulation is only 25.8% of the time for the full model. The figure on the right shows the quality of the reduced model.



Comparison of the time-domain simulation results for the rotor angle response of the same generator following a contingency

Specifications and Requirements

- Processing power systems of up to 100,000 buses and 15,000 generators.
- Runs on the MS Windows 2000/XP/Vista/7 platform.
- 512 MB RAM (1 GB recommended).

Other Powertech Services

- Evaluation of transfer capability and security limits
 - Powerflow analysis
 - Transient Stability analysis
 - Small-Signal Stability analysis
 - Voltage Stability analysis
- Post-mortem analysis of system disturbances
- Frequency control assessment
 - Islanding studies
 - AGC & governor performance
 - Design and evaluation of under-frequency load-shedding schemes
- Increasing transfer capability
 - Control-tuning and design
 - Load shedding schemes
 - Reactive compensation planning
 - Special protection system design and verification
- Assessment of planning alternatives
- Custom modelling & dynamic model reduction
- Reliability Assessment of power systems
- Generator field testing, model development & validation
- Load characteristic measurement and model development
- Custom software and model development
- Training

In addition to extensive power system study capabilities, Powertech has a \$50 million lab and test facility which includes high voltage, high current, and high power labs, as well as capabilities in hydrogen technologies, chemistry, metallurgy, and materials engineering.

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