

Electromagnetic transient analysis



Mott MacDonald has extensive expertise and experience in the modelling of power system transients using electromagnetic transient programs. Our experience covers the entire range of transient events from low frequency sub-synchronous turbine generator torsional vibrations (<50Hz), mid frequency switching transients (50Hz to 20kHz), and high frequency, fast front studies (up to 1MHz).

For studies, we often use the world's most-advanced electromagnetic transients program, PSCAD/EMTDC. We possess in-depth understanding of common and not-so-common electrical system transient issues on industrial systems, and also on utility transmission and distribution systems. Our applied transient modelling techniques enable us to understand and determine appropriate mitigation for non-standard power system problems.

Mott MacDonald has used transient studies to identify potential issues on new build systems, and has successfully explained and devised appropriate mitigation for transient problems experienced on operational systems.

Our extensive expertise includes:

- Assessment of electrical and mechanical system interactions in variable speed drives and turbine generators
- Assessment of fault current limiter operation
- Circuit breaker transient recovery voltage (TRV) calculations
- Development of turbine generator controllers and power management systems
- Insulation co-ordination and assessment of rating
- Overhead transmission line and cable transients
- Placement of surge arresters
- Transformer inrush and capacitor and filter bank switching transients
- Unique pulse power applications

Carbon has become central to design and we are helping our customers address carbon alongside wider environmental, resource, social, safety, performance, quality, cost and economic considerations. We are also helping companies, communities and governments prepare adaptation strategies in anticipation of the more extreme conditions of drought, flood, storminess and temperature that are predicted.





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Efficient and cost effective results

Mott MacDonald can carry out analysis using the extensive experience of our staff. Our experts can focus on issues of concern immediately and model the system in appropriate detail, avoiding the common mistake of including too much elemental information when not required. We achieve the required detail in results without affecting accuracy. These factors enable work to be carried out quickly and cost effectively – important benefits in a technological area where analysis can be expensive and time consuming.

Co-operation with the developers of the PSCAD/EMTDC program has led to the development of new models and features in the program based on requirements identified during our system studies.

Expertise based on experience

While systems modelling is reliant on quality software, it is even more reliant on quality analysts who understand the phenomena being modelled. Mott MacDonald has such experts, experienced in most system types and in accurately interpreting model results. This enables them to provide solutions to problems either at the design stage – the most cost effective time to implement changes – or on existing systems, where operational difficulties are traced to issues that need to be modelled to understand and alleviate them.

Harmonics and inter-harmonics

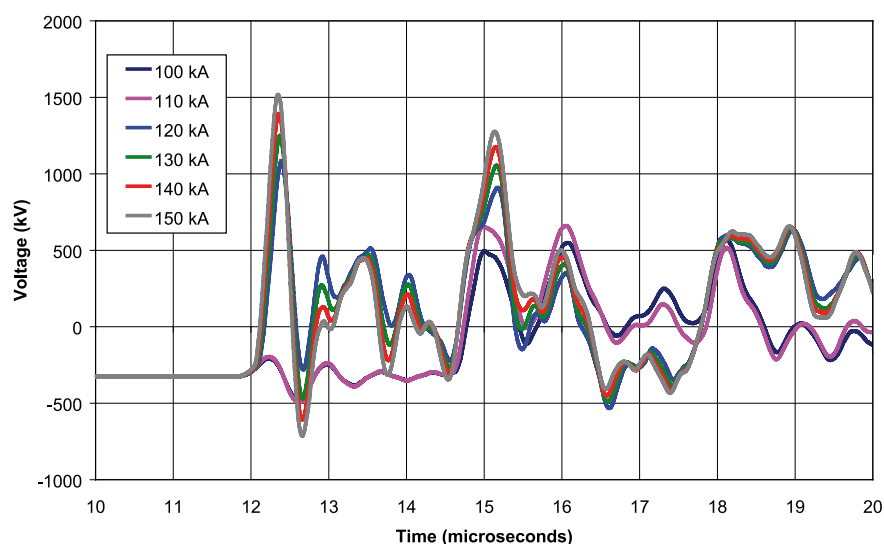
Mott MacDonald has used PSCAD/EMTDC to model system harmonics and inter-harmonics in the time domain – where standard frequency domain techniques may not be suitable – by modelling converters at switching device level. We can import data from standard load flow programs directly into time domain models using the ETRAN translation program. This allows detailed and harmonic impedance calculations to be performed using frequency dependent overhead line and cable models.

Recent projects include:

- Solution to a long-standing protection problem on a 275kV transmission system
- Identification of system over-voltages caused by transformer inrush exciting a low frequency power system resonance
- Explanation for incorrect operation of fault current limiters in an industrial distribution system

In each case we utilised analysis and modelling tools to advise on appropriate mitigation that was successfully applied in practice.

Substation lightning induced overvoltages



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