OPTIMAL TECHNOLOGIES

SUMMARY SENTENCE: the summary of the case study here....(will do this last)

AEMPFAST

Case Study Four

Challenge

Optimal entered into a Consulting Agreement with the California Independent System Operator Corporation (the "ISO") in 2004 to demonstrate AEMPFAST Optimization Algorithms, Bulk Power Examples, Optimal, using an early version of AEMPFAST.

As a first task Work Order, Optimal performed several "Test Tasks for Optimization Algorithms" authored by CAISO engineers, using WECC and PG&E datasets sent to Optimal in .epc format. The Test Tasks included development and demonstration of solutions to specified test problems, evaluation of AEMPFAST features developed to that date, and discussion of how OPTIMAL would solve the Test tasks.

The Test Tasks included several Bulk Power System Examples as test study cases, including "no feasible solution" cases, a "hard to solve" case, a "constrained optimization problem", and variations on typical "reliability-must-run (RMR)" cases, with specific tasks directed for each case study, and with all final AEMPFAST solutions checked by testing them with the PSLF model.

Among the AEMPFAST features that were evaluated in Optimal's performance of the Test Tasks were "reliable convergence" and "ability to solve unfeasible power flows (finding the closest feasible point)".

Solution

Optimal engineers spent approximately four weeks loading the datasets onto AEMPFAST, familiarizing themselves with the test case systems, and conducting the test analyses. A California ISO delegation comprised of three engineers spent two days in Calgary with the Optimal AEMPFAST staff to test the AEMPFAST engine for solving the test cases.

Results

The CAISO delegation prepared an evaluation of the AEMPFAST test results. At the time of the test, in June, 2004, AEMPFAST was at an incomplete stage and the evaluation noted various functionalities that at the time were yet to be completed and therefore unobservable.

On features that were observable, the "Summary of Test Results" stated, in pertinent part,

> "California ISO engineers were favorably impressed with the performance of the AEMPFAST core solution engine and they were finally convinced that in several important aspects (for example, reliable convergence), it was as good as [Optimal] had claimed. It does find a feasible solution even when the system is stressed to the limit and beyond. It can solve difficult cases

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- TBD - for now include what AEMPFAST Service item it is related to here

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that the PSLF (the GE program used by the California ISO) is not able to solve."

More particularly, the CAISO evaluation stated the following:

"Reliable convergence:

- "CAISO confirms that AEMPFAST has demonstrated excellent performance in at least two hard to crack situations. However, the case used included only the PG&E system (around 3000 buses) and not the whole WECC (approximately 13500 buses). One of them was the case where a branch with a very small impedance was introduced. Typically, power flow algorithms do not converge in such cases due to the difficulties with numerical calculations (the Jacobian matrix becomes ill-conditioned). Nevertheless, AEMPFAST was able to find solutions.

"Solving unfeasible power flows (finding the closest feasible point):

- "This test is important to check whether AEMPFAST is capable of tracing voltage and angle stability boundaries. AEMPFAST has demonstrated an outstanding performance while we attempted to solve a power flow case with no solutions, although we can't claim that we understand the results completely. To build the case, we scaled one of the bus loads up to the level where no solution could be found. The CAISO PSLF program diverged with the power flow mismatched increasing chaotically. AEMPFAST demonstrated an excellent convergence pattern with the mismatches steadily decreasing. This was a clear demonstration of the AEMPFAST superiority."

As a result of its favorable evaluation of AEMPFAST through the Test Tasks, CAISO engaged Optimal to proceed with creation of a detailed specification for the development of "A New Tool that Three Dimensionally Determines and Enlarges the Secure Operational Region (SOR) in the California ISO Control Area Using Optimal Technologies (USA) Inc.'s Advanced Analysis and Optimization Toolset". In cooperation with CAISO engineers, Optimal completed the detailed specification for the 3-D SOR in 2004-2005.

About Optimal

If room a boiler plate of Optimal at bottom (will address last).