DEVIATION ANALYSES USING PEPSE®

Michael Hunt

Louisiana Power & Light Company

ABSTRACT

PEPSE, when properly utilized, can be a powerful tool for calculating plant component performance deficiencies.

Case-to-case parameter value transfer in a single run submittal greatly simplifies performance test analysis. PEPSE Special Option 6 or an alternative method using PEPSE special features may be used to construct a plant deviation analysis model. Such a model that extensively uses PEPSE special features, was constructed for nuclear cycle performance analysis.

This model may be used for calculating component performance deviations, identifying suspect instrumentation, and help to optimize operator controllable parameters.

OVERVIEW

One major use of PEPSE is to calculate the deviation from design for each component of the subject unit. The user has available several methods of accomplishing this, one method is PEPSE Spectial Option Number 6.

Special Option Number 6 automates performance test analysis by providing case-to-case parameter value transfer in a single run submittal. The process is a series of steps (stacked cases using the save or change case special features) as follows.

1. Benchmark analysis step
2. Test data reduction step
3. Standardization step
4. Subsystem performance upgrade step
5. Additional upgrade step

   ...etc. with repetition until complete.

Special Option Number 6 is a very useful tool, however there are limitations with this method of performance test analysis. The major limitations are:

1. The turbine sections must be general turbine solution method Type 8.
2. The standardization step automatically activates Special Option Number 1.

OVERVIEW (Continuation):

Since benchmark or design models had been developed using the G.E. Procedures solution method it was desirable to retain this method during the test data reduction and the turbine performance upgrade steps. Additionally the subject unit was a nuclear cycle and special Option Number 4 was felt to be more applicable than Special Option Number 1.

PEPSE Special Features were reviewed and it was determined an alternative to Special Option Number 6 could be successfully developed.

KEY ELEMENT - THE SAVE CASE FEATURE

The save case feature permits the user to request that the code employ the results from the preceding case when starting the iteration for a new case.

Referring to Example Number 1 let us analyze how this feature may be used as the input data for a following case.

As can be seen from this example an output parameter from Case 1 is stored in a dummy operational variable. This dummy operational variable can then be retrieved for use as an input variable in Case No. 2. There are limitations and precautions when using this feature and the potential user is recommended to thoroughly review Volume 1 of the PEPSE manual.

Data Transfer Demonstration

```
Case No. 1        * Store Output Data in Dummy Operational Variables

                870020                0.00
                880010          EHPP,  100,  ADD,  OPVB,  2,  OPVB,  1
                  .
Case No. 2        *Retrieve Dummy Operational Variable for Use as Input

                880010          OPVB,  1,  ADD,  OPVB,  2,  EFFTRE,  200
```


Example Number 1

KEY ELEMENT - THE SAVE CASE FEATURE (Continuation):

With this knowledge in hand, an alternative PEPSE Deviation Analysis model was developed.

Figure Number 1 illustrates the layout of this alternative model.

The first case uses GE Procedures turbine sections. Plant test data is input and the actual plant performance is calculated. Output parameters that define the performance of each subsystem are stored in dummy operational variables. In the second case the dummy variable are called up for use as input. This model uses General Turbine Type 8 sections.

The reason for switching solution methods is to define the plant performance in a "flexible" format (i.e. turbine efficiencies and flow coefficents; and FW heater TTDs and DCAs; and other equipment). Once the model is defined in this "flexible" format, deviation studies may be performed. The studies may include correction to standard conditions (ASME Group 1&2 corrections), or analyses at fixed valve position (PEPSE Option 1) or fixed thermal power (PEPSE Option 4). Components may then be substitued one at a time, cumulatively, until the model is all design components. Thus, the performance deviation of each desired component may be calculated.

PEPSE Deviation Analysis Model Diagram

Case No. 1	Turbine Type G.E. Procedures	Test Data Input - Temperatures,Pressures, Flows,Power,Etc.
	Output Data Stored in Dummy Operational Variables; Retreived for Case No.2 Input **Save Case**	
Case No. 2	Turbine Type 8 **Save Case**	"Flexible Format" Model
Case No. 3	Standardization Step (Optional) **Save Case**	ASME Group 1 +/or 2 Corrections PEPSE Special Options 1 or 4 (In All Following Cases)
Case No. 4	First Subsystem Upgrade **Save Case**	Deviation From Case No. 4 to Case No. 5 Attributable to the Case No. 5 Subsystem Upgrade
Case No. 5	Next Subsystem Upgrade **Save Case**	
Case No. x	Last Subsystem Upgrade	

Figure Number 1

USES OF THE DEVIATION ANALYSIS MODEL

Automation of performance test analysis can provide the following.

1. Identify and quantify deficient equipment performance
2. Quantify off-design operator controllable parameters
3. Identify suspect instrumentation

The one-run submittal simplifies the performance test analysis such that test data may be analyzed as frequently (normally weekly) as desired. This data may then be assembled into a plant deviation report. Example No. 2 illustrates one possible format for a nuclear cycle. In this example the test versus design calculations have been calculated at actual conditions (test values of initial steam conditions and circulating water temperature).

CONCLUSIONS

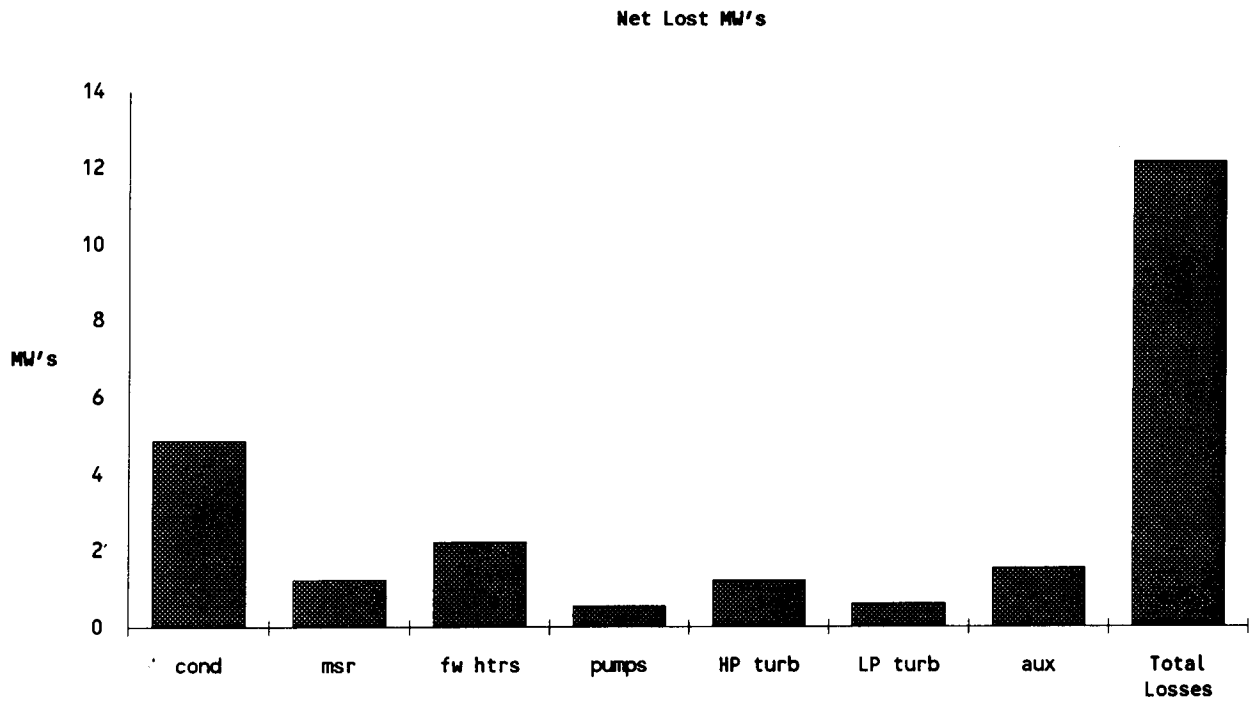
An alternative method of automatic performance test analysis was developed. The save case special feature has been successfully used to transfer output parameters from one case for use as input in a following case.

This methods enables the use of GE Procedures calculations during the test calculation case and the ability to use Special Option 4 during the standardization case.

PERFORMANCE REPORT
GENERIC NUCLEAR PLANT

Date - 6/17/89

ITEM	TEST	DESIGN
Power MWt	3397.35	3397.35
Gross Gen MW	1143.42	1153.72
Aux Load MW	50.60	49.10
Net Gen MW(actual conditions)	1092.82	1104.62
Net HR.(actual conditions)Btu/KWH	10607.64	10494.32
Sec. Cal. Power	99.505	N/A
Circ. Water Inlet Temp Deg. F	68.3	N/A
Condenser C.F. %	72.6	90.00



Example Number 2