

Transient Thermal Modelling of Heat Recovery Steam Generators in Combined Cycle Power Plants

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Summary

Heat Recovery Steam Generator (HRSG) is a major component of a Combined Cycle Power Plant (CCPP). This equipment is particularly subject to severe thermal stress especially during cold start-up period. Hence it is important to predict the operational parameters of HRSGs such as temperature of steam, water, hot gas and tube metal of heating elements as well as pressure change in drums during transient and steady state operation. These parameters may be used for estimating thermal and mechanical stresses which are important in HRSG design and operation.

In this paper, the results of a developed thermal model for predicting the working conditions of HRSG elements during transient and steady state operations are reported. The model is capable of analyzing arbitrary number of pressure levels and any number of elements such as superheater, evaporator, economizer, deaerator, desuperheater, reheater, as well as duct burners.

To assess the correct performance of the developed model two kinds of data verification were performed. In the first kind of data verification, the program output was compared with the measured data collected from a cold start-up of an HRSG at Tehran CCPP. The variations of gas, water/steam and metal temperatures at various sections of HRSG, and pressure in drums were among the studied parameters. Mean differences about 3.8% for temperature and about 9.2% for pressure were observed in this data comparison. In the second kind of data verification, the steady state numerical output of the model was checked with the output of the well-known commercial software. An average difference about 1.5% was found between two latter groups of data.

Keywords: Heat Recovery steam generator (HRSG), Thermal analysis, Transient modelling

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