INSTATIONÄRE WÄRMETECHNISCHE RECHNUNGEN ALS GRUNDLAGE FÜR DIE SPANNUNGSANALYSE VON DAMPFERZEUGERN UND WÄRMETAUSCHERN

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The assessment and design of heat transfer equipment is based on thermal calculations. Efficient computer programs enabling an exact prediction of the transient behaviour of steam generators have become available only recently. The relevant computer program development at Waagner-Biró AG is described.

The Waagner-Biró computer code TRANS was developed especially for the analysis of the dynamic (transient) behaviour of once-through steam generators with any geometry and flow arrangement. Temperature, mass flow rate and pressure of both primary and secondary medium can be introduced as time dependent functions. Combinations of the above variables, simultaneously or consecutively, are possible. The results include time functions of temperature, mass flow rate and pressure of both media at any location in the steam generator. The program can also be used for heat exchangers; no limitations exist concerning the type of the primary and secondary medium.

The complexity of the heat and mass transport problems dealt with in the TRANS program necessitated a limitation in the geometric barrier between primary and secondary medium. This barrier has been fixed to be a tube; its diameter, wall thickness and material can be selected independently for each section. More complicated geometries like headers and tube plates cannot be introduced into the program. Such components are of less or no importance for heat transfer calculations which are performed in the TRANS program, but in general represent the most critical and determining parts from the point of view of stress analysis.

Thus, a separate code, TRALIN, has been developed by means of which temperature fields, both stationary and transient, for bodies of any geometric shape can be calculated. Thermal data are introduced as boundary conditions, e.g. time functions of local temperature and heat transfer coefficient for one or more media in contact with a specific face of the body; the geometry is represented by a fine subdivision of the structure, similar to the "finite element" method in stress calculation. This has the advantage that the TRALIN results can be used directly in a finite element stress program or that in a following program step the stress calculation can be performed directly on the basis of the transient temperature distribution any given time.

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