TECHNIQUE FOR DETERMINATION OF PHASE CHANGES IN MOIST AIR FLOW IN A BLADE CASCADE

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ABSTRACT

Phase changes in moist air flow appear to be a problem for operation of flow systems, namely for operation of wind tunnels, turbomachines, etc. Partially solidified and liquidized steam in moist air changes properties of fluid and at its interaction with solid surfaces can modify flow parts considerably. Determination of phase change conditions is based on thermodynamic theory. Data on phase change of water are given by the International Association for Properties of Water and Steam [1], [2]. From thermodynamic theory of moist air, it is possible to solve pressure and temperature of saturated homogeneous moist air for given specific humidity [3]. Parameters of homogeneous moist air are given for solution of expansion process which is simulated at calculations. Conditions of saturation are successively verified and finally determined. This iteration process is very fast. In the case of achievement of the state of heterogeneous conditions of moist air, separated phase is determined. Occurrence of liquid in the form of small droplets or solid phase as ice or snow can be solved as a result of calculation.

Calculation software for solution of expansion of moist air is prepared [4] and can be used as a support for investigations at high-speed aerodynamic research. Likewise it can be used for calculations during design of turbomachines. Special phase diagram for moist air is designed. In principle it is p-t diagram in which limits of saturated moist air are drawn. The diagram is shown in Fig.1. Red lines are the limits with saturated moist air. Blue lines present isentropic process in moist air.

Influence of phase changes in blade cascade flow at wind tunnel tests is presented namely for kinetic energy loss coefficient [5].

REFERENCES

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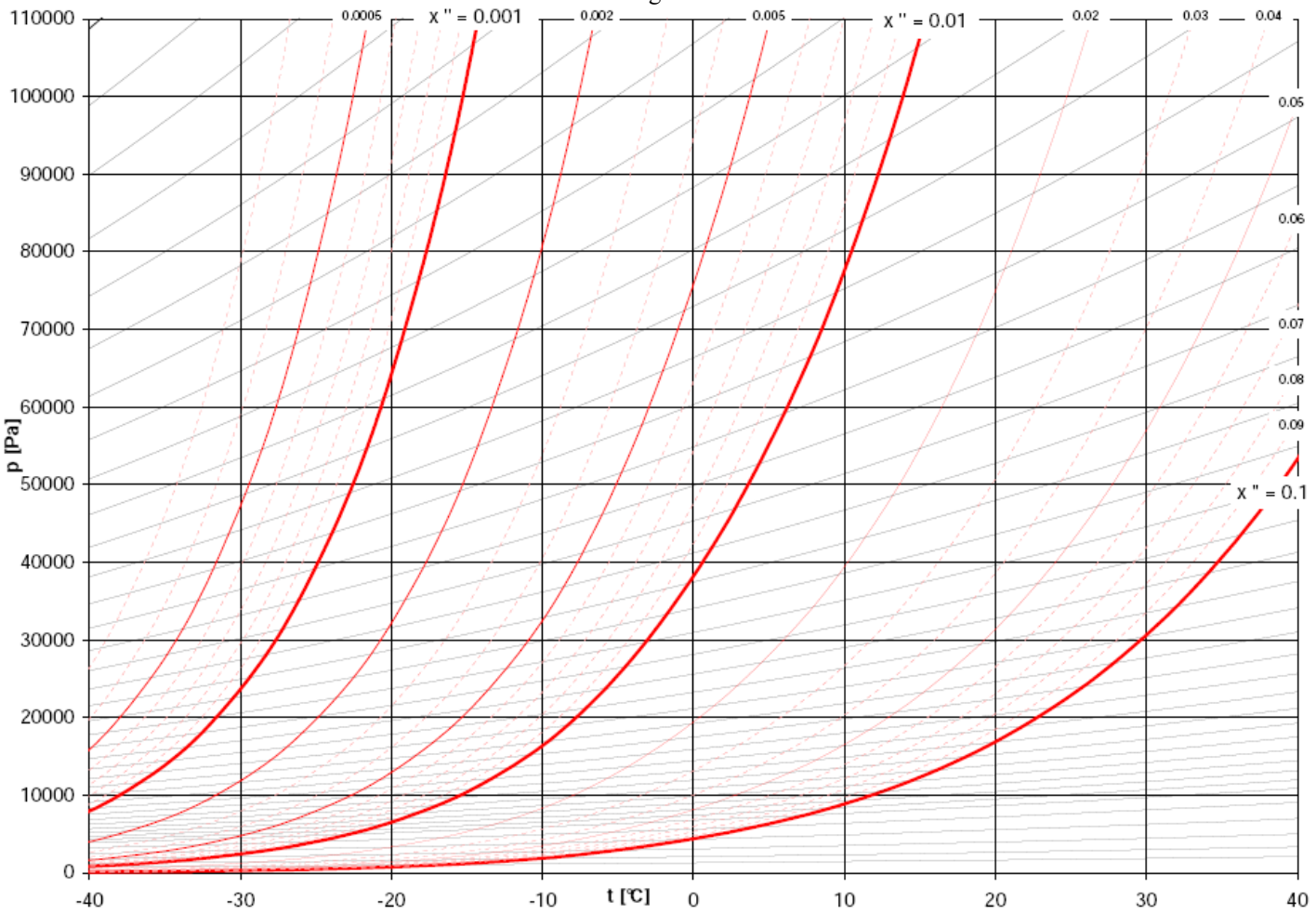

Figure 1. Diagram for evaluation parameters at moist air expansion and limits with saturated moist air.