EFFICIENT EVALUATION OF THERMOPHYSICAL PROPERTIES OF WORKING FLUIDS FOR ORGANIC RANKINE CYCLES

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ABSTRACT

The overall topic of this tutorial session is a description of the models that underpin the state-of-the-art thermophysical property libraries, and how these properties can be retrieved in a computationally efficient manner. The emphasis will be placed on the use of the REFPROP property library developed at the National Institute of Standards and Technology (NIST), though other libraries will also be described in some detail.

The first topic of the tutorial session will be a theoretical description of how the models (equations of state, mixture models, transport property formulations, etc.) are constructed. The emphasis of this section will be to describe the theory in a way that is relevant to end-users, such that they can understand the implications of these model formulations on their own code that they write.

Secondly, we will describe the use of the NIST REFPROP library to calculate the parameters of interest, including thermodynamic properties, derivatives of thermophysical properties, mixture phase envelopes, etc. An emphasis will be placed on the different means that can be used to maximize computational efficiency. Furthermore, the various options available for interfacing with REFPROP will be described, including the use of the CoolProp thermophysical property library.

Finally, we will present work that has been recently carried out to use the bicubic tabular interpolation methods of CoolProp to achieve computational speeds for fixed-composition mixtures from REFPROP that are on the order of the computational speed of mixtures that are treated as pseudo-pure fluids. This should be of particular interest to researchers that are carrying out dynamic simulation studies with zeotropic mixtures, as has been proposed in the literature for Organic Rankine Cycles.