



THE BASICS, BEAUTY AND BENEFITS OF MIXED CONVECTIVE FLOW

Marilize Everts^{1*}

¹Department of Mechanical Engineering, University College London, London WC1E 7JE, United Kingdom

ABSTRACT

As the rate of heat transfer is proportional to temperature difference, temperature differences within fluids form an integral part of heat exchangers. In the presence of gravity, these temperature differences lead to density difference due to the variation of the fluid properties with temperature. The rise of the warmer fluid near the heated surface and the descend of the colder fluid near the center of the channel leads to the formation of secondary flow vortices which enhances heat transfer inside the heat exchanger. Owing to its significance and presence in most heat exchangers, mixed convective flow through channels was investigated from various perspectives over the past decade to gain an improved fundamental understanding and accurately account for it in heat exchanger design.

This lecture will give an overview of the basic development and impact of mixed convective flow considering factors such as thermal boundary conditions, tube geometry and orientation and geometry, as well as heat transfer fluids. Thereafter, the beauty of mixed convective flow behaviour is discussed by combining accurate experimental data with computational fluid dynamics. Finally, accurate correlations and flow regime maps are presented as design tools to incorporate the benefits of mixed convective flow in thermal management systems.

*Corresponding Author: m.everts@ucl.ac.uk