Modelling and Numerical Simulation of Fluid Flow and Heat Transfer in Thermoplates

This thesis deals with the forced convection and heat transfer in a parallel plate channel and in thermoplates under thermally symmetrical and asymmetrical boundary conditions. In case of asymmetrically heated parallel plate channel the dimensionless energy equation could be solved. Depending on the boundary conditions, the Nusselt number distribution at one of the plates could experience a vertical asymtote and a zero value.
The heat transfer can be increased up to four times in comparison to the parallel plate channel when thermoplates are used. This enhancement has to be paid through higher pressure drop and pumping power. The numerical experiments reveal that the staggered welding spot pattern should be used to achieve better heat transfer. Using a thermoplate that has even surface for the most part surface does not increase the heat transfer noticeable in comparison to the parallel plate channel. However, the low values of the pressure drop and pumping power result in a convenient thermo-fluid characteristic for such kind of thermoplates. Some of the numerical results from this thesis could be compared to the laboratory experiments. A very good agreement was observed when Marlotherm oil was used as a test fluid. However, the comparison indicates, that the turbulence effects can not be neglected particularly at higher Reynolds numbers.