

TRANSIENT ANALYSIS OF TWO PHASE FLOW OF REFRIGERANT INSIDE A HORIZONTAL TUBE FOR THE PREDICTION OF FLOW REGIME

P. Bhramara* K.V. Sharma † T.K.K. Reddy *

* Department of Mechanical Engineering, JNTUH College of Engineering, Hyderabad, AP 500085,
INDIA

† Department of Mechanical Engineering, University Malaysia Pahang, 26300 MALAYSIA

bhramara74@yahoo.com and kvsharmajntur@yahoo.com

In-tube two phase vapor- liquid flows are encountered over a wide range of industrial applications, particularly in Refrigeration and Air conditioning industry. One of the major difficulties in the modeling of two phase vapor-liquid flow is the determination of the geometry of the flow field, which can adopt several configurations commonly referred to as flow patterns or flow regimes. Many analytical/ semi empirical correlations are available in the literature for predominantly annular flow regime. In addition, many flow regime maps had been developed based on experimental data. Growing computer facilities provide the flexibility to construct and use large scale computational models to calculate these complex two phase flow types and thus experimental research is not always needed.

In the present work, CFD analysis of vapor- liquid flow of refrigerant, R134a at a saturation temperature of 40°C inside a horizontal tube under transient conditions is considered. The flow regimes obtained are compared with Hajal-Thome flow regime map for a tube of diameter 8 mm and length, 1200 mm. The flow is modeled using VOF model from the existing Eulerian-Eulerian models in CFD code. Because of the dynamic behavior of two phase flow, a transient simulation is performed and four commonly observed flow regimes, stratified, wavy, slug/plug and annular flow regimes [2] are reproduced using VOF model [3].

Keywords: Flow Regime, Transient Simulation, Two Phase Flow, VOF model

References

Baker, O., Simultaneous flow of oil and gas, The Oil and Gas Journal, Vol.53, pp.185- 195, 1954.

Carey, V.P., Liquid- Vapor Phase Change Phenomena, Taylor & Francis Group, 1992.

2 *Topics*

Schepper, S.C.K., Heynderickx, G.J., Marin, G.B., CFD modeling of all gas- liquid and vapor- liquid flow regimes predicted by Baker Chart, *Chemical Engineering Journal*, Vol.138, pp.349- 357, 2008.