

Examination of temperature probe setup using computational fluid dynamics simulators

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Engineering problem solving such as process design, process optimization, safety analysis, etc.; relies widely on mathematical models of the process. One of the most important aspects in a chemical plant is the safety protocols assuring the safety of workers and equipment. In this study Computational Fluid Dynamics (CFD) methods are used to model different temperature probe positions in a pipe elbow. Different models were computed together in order to solve heat transfer model: heat transfer in fluid and solid substances and momentum balance model. Three probe geometries are defined to obtain different results containing velocity field, and heat transfer. Based on the results the geometries and positions are compared to each other in order to find out which position is the most suitable for control studies, based on the time response of the probes. COMSOL Multiphysics was used to implement and to couple of the physics models. Due to the number of the geometries and model parameters (position and the geometry of the probe; inlet velocity) the COMSOL model was connected to MATLAB via COMSOL MATLAB LiveLink for solving the repeatable steps.

Keywords: Computational Fluid Dynamics, heat transfer, temperature probe position