

UNIVERSITI TEKNOLOGI MARA

**FLUID STRUCTURE INTERACTION
(FSI): STUDY OF MULTIPHASE
FLOW AT T-JUNCTION**

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ABSTRACT

In oil and gas industry, multiphase flow is a common phenomenon of the flow happened during the production phase. Multiphase flow is considered as a complex flow regime and need extra analysis tool to separate the fluid. The example of multiphase flow are gas-liquid flow, liquid-solid flow and solid-gas flow. Hence, pipeline is the most important equipment in industrial application to provide a good channel for the transportation of the multiphase flow. T-junction is the one of the important component of the pipeline system. The simulation of the multiphase flow when entering the T-junction is analyse by using Computational Fluid Dynamic (CFD). Eulerian model is utilized using software ANSYS FLUENT Workbench 15.0. The paper presents the modelling of the multiphase flow and the deformation of the structure when the fluid is impacting the T-junction. The Fluid Structure Interaction (FSI) of the multiphase flow on the T-junction that causing to the erosion is investigated.

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CHAPTER ONE

INTRODUCTION

1.1 RESEARCH BACKGROUND

Multiphase flow can be defined as more than one flow occurs in a flow field such as solid, liquid or gas stream. Multiphase flow is a kind of simultaneous flow of the materials with different states of phases as mentioned above. It also identified as the materials with different chemical properties but still in the same states or phase such as oil droplets in water. Multiphase flow can be classified as either two phase flow (i.e. solid-liquid flow, solid-gas flow, liquid-liquid flow and liquid gas flow) or three phase flow (i.e. gas-liquid-solid flow, gas-liquid-liquid flow and solid-liquid-liquid flow). The study of multiphase flow is very essential in energy related industry especially in oil and gas industry (Thermopedia.com, 2017).

The examples of multiphase flow that contribute in oil and gas industry are flow of mud (solid-liquid flow), injection of water in oil flowing pipe (liquid-liquid flow), fluidized beds (solid-gas flow), heat transfer during the transportation of the oil (gas-liquid flow), gas-oil-water flow in oil recovery system (gas-liquid-liquid flow) and two phase fluidized bed and gas lift chemical reactor in which gas-liquid promoted by the existence of the solid catalyst particles suspended in the mixture (gas-liquid-solid flow) (Thermopedia.com, 2017). The fluid system is divided into two phases which are primary phase and secondary phase. Primary phase is a continuous phase and secondary phase is a material that is considered to be dispersed within continuous phase (Athulya & Miji Cherian, 2016).

In oil and gas industry, pipelines is used globally to transport crude oil and natural gas. This considered as multiphase flow happened in the pipelines which is related to the study for this paper. In the pipeline system, T-junction are one of the important part (Athulya & Miji Cherian, 2016) . Junctions between pipes have ability to split or mix the fluid when flowing to the junction (Thermopedia.com, 2017). When two phase flow enter at T-junction, both will separate. The heavier phase will flow towards the main