# UNIVERSITI TEKNOLOGI MARA

# OPTIMIZATION OF AUTONOMOUS INFLOW CONTROL DEVICE PERFORMANCE THROUGH EVALUATION STUDY ON PRESSURE DISTRIBUTION ON LEVITATING DISC

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# ABSTRACT

Oil and gas industry is facing critical challenge in maintaining production performance. High water production due to strong aquifer and water injection decrease the performance of a well. Implementation of Autonomous Inflow Control Device inside a completion system shall help improve the total performance of a well. The device work autonomously where a levitating disc control the inflow based on the composition and velocity of the fluid produced. Each field require specific design of the device to be implemented. The purpose of this paper is to determine the optimum flow area for the device to work effectively in a well condition specified. This will verify the effects of a few design parameter of the device focused such as inlet area, disc size and outlet size. Simulations using ANSYS Fluent were done by adjusting the design parameters to obtain favourable results. The results were analysed based on the differential pressure exerted on the disc. These optimum parameters shall indicate that the levitating disc will work effectively and autonomously inside the completion string during production. It will also verify that the design parameters are critical to ensure that the production performance was enhanced.

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# CHAPTER ONE

# INTRODUCTION

## 1.1 RESEARCH BACKGROUND

For the last two decades, water production has become a severe and complicated issue in oil and gas industry[1]. People in the industry around the globe have been trying to anticipate this problem to optimize their production with the best of their abilities which has always been the most critical challenges in the field. Typically, inside oil formation underground, presents of water cannot be avoided which in certain situation acts as an important element in producing the oil[2]. This water can provide necessary drive for the hydrocarbon to be extracted and contribute to maintaining the reservoir pressure. An underground formation of water-bearing permeable rock, unconsolidated materials such as gravel, sand, silt of rock fractures which water can easily move is called aquifer[3]. In some cases, water injection is also applied to the formation to fulfil the needs of water drive to push the oil out of the formation to the producing well and maintaining the reservoir pressure so that gas that usually contain inside the extracted fluid would not break out of the solution. This is critical in optimizing production and minimizing production problem.

However, during production, the water is inevitably produced due to the encroachment of water from the aquifer or the injected water. Sometimes the volume of produced water is higher than the oil. At some point in the producing life of a well, this ratio of oil to water became too small and reaches its economical limits. When this happens, the well needs to be shut off. In a field where this high water production problem was not addressed efficiently from the beginning of the well's early production life, there is still high quantity of oil trapped inside the formation when the wells are shut