



**CALIFORNIA SCIENCE & ENGINEERING FAIR
2018 PROJECT SUMMARY**

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| Name(s) Alex Puga | Project Number J1809 |
| Project Title Vibrating the Oil-Water Mixture to Infer Water Cut | |
| Abstract Objectives/Goals This experiment is based on the fact that Water Cut measurement continues to be a challenge in the oil industry. The purpose of this project is to determine what type of correlation exists between the total water percentage in an oil-water mixture and the frequency emitted by a vibrating tuning fork in that medium, as a means of testing a possible alternative to current Water Cut measuring technologies; and if this relationship can be used to infer the Water Cut in a given mixture. Methods/Materials For this experiment, tap water and Motor Oil were utilized. A Rosemount 2140 Level Detector, a tuning-fork like device, was used to measure the vibration frequency of the tuning fork when immersed in different volumetric oil-water ratios. Multiple readings were taken for each ratio, and later graphed in Excel. Results It was confirmed that there is a correlation between the vibration frequency of a tuning fork and the Water Cut in the target medium. As the Water Cut increased, the frequency emitted by the tuning fork when immersed in the medium would decrease. The equation and graph generated by Excel showed that the correlation between frequency and Water Cut is polynomial. This relationship can be used to infer the Water Cut in a given oil-water mixture by measuring the frequency of the tuning fork. However, this method of measurement appears to have some limitations in the upper Water Cut levels - that is, values greater than 90% Water Cut. Conclusions/Discussion Water Cut measurement continues to be a challenge in the oil industry. In fact, technology is still seeking for and developing alternative methods of measurement that are simpler and accurate, as quick and precise Water Cut measurement is essential to the oil industry for many reasons. This project serves as an alternative method for the measuring the Water Cut of an oil-water mixture by using the frequency of a vibrating tuning fork to infer the water percentage in the target medium. In addition, this technique could also be used to determine the interface level in a three-phase separator. | |
| Summary Statement The frequency at which a tuning fork vibrates in an oil-water mixture can be used as an alternative method for determining the Water Cut (water percentage) in that mixture. | |
| Help Received A Rosemount 2140 Level Detector was utilized in this project with the help and supervision of my father. | |