**Master – Thesis 11.03.2025**

## **Data analysis of PIV measurements and CFD simulations on the mixing process in biogas plants**

#Description

# Import necessary libraries

# (hypothetical for simulation and data analysis)

import numpy as np

import matplotlib.pyplot as plt

**# Task Definition**

def literature\_research():

 """Conduct a literature review on PIV measurements and CFD validation methods."""

 print("Step 1: Reviewing relevant literature...")

def define\_target\_parameters():

 """Define key target parameters for evaluating mixing efficiency based on PIV and CFD data."""

 parameters = ["Velocity distribution", "Turbulence intensity", "Mixing time"]

 print("Defined Target Parameters:", parameters)

 return parameters

def compare\_piv\_cfd\_data(parameters):

 """Compare PIV measurements from real plant and model fermenter with existing CFD results."""

 datasets = ["Real Plant PIV", "Model Fermenter PIV", "Model Fermenter CFD"]

 results = {dataset: {param: np.random.rand() for param in parameters} for dataset in datasets}

 print("Comparison of PIV and CFD data:", results)

 return results

def analyze\_geometry\_comparison(parameters):

 """Use existing CFD data to compare different geometries based on defined target parameters."""

 geometries = ["Real Plant", "Model Fermenter", "CFD Model"]

 results = {geo: {param: np.random.rand() for param in parameters} for geo in geometries}

 print("Comparison of geometries based on target parameters:", results)

 return results

def derive\_sensor\_positioning():

 """Analyze CFD and PIV data to derive positioning criteria for a mixing quality sensor system."""

 print("Deriving optimal sensor positioning criteria based on data analysis...")

 # Placeholder for logic to determine best sensor placement

def improve\_experiments():

 """Suggest improvements for future PIV experiments to enhance data quality."""

 print("Providing recommendations for experimental improvements...")

 # Placeholder for improvement suggestions

# Execution Order

if \_\_name\_\_ == "\_\_main\_\_":

 literature\_research()

 params = define\_target\_parameters()

 results\_piv\_cfd = compare\_piv\_cfd\_data(params)

 results\_geometry = analyze\_geometry\_comparison(params)

 derive\_sensor\_positioning()

 improve\_experiments()

**# Thesis Metadata**

thesis = {

 "Title": "Data analysis of PIV measurements and CFD simulations on the mixing process in biogas plants",

 "Supervisor": "Bernhard Huber",

 "Institute": "Chair of Regenerative Energy Systems, TUM",

 "Location": "Schulgasse 16, 94315 Straubing, Room 0.A10",

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 },

 "Earliest Start": "2025-04-01"

}

**#Requirements**

# Basic knowledge of Ansys Fluent

# Advanced programming skills in Python and Matlab

# If you think you are the right candidate to solve this task please contact me.