

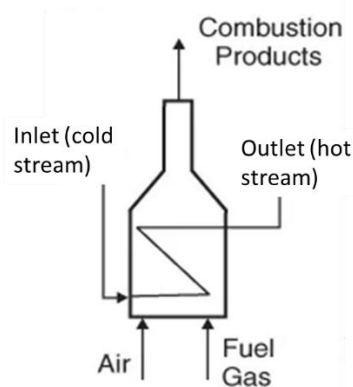
PHENOMENA VISUALIZATION

Task description – Project MMST WiSe 2021/2022

INTRODUCTION

In controlling complex processes via a Human-Machine-Interface (HMI), sometimes it is challenging for the user to make a decision or imagine the effect of a decision on the performance of the system. Of course, the decision about one equipment can affect the next process steps as well; however, this project aims at concentrating on only one equipment and visualizing the phenomena taking place in that equipment to help the user be aware of the effects of his decisions.

The use case in this project is a furnace, in which a stream is heated by the energy released from a fuel. In commonly used Process and Instrument Diagrams (P&IDs), a furnace is illustrated as follows:



Conventional illustration of a furnace

PROJECT DESCRIPTION

As can be seen, this illustration does not explain the phenomena taking place in the furnace. Actually, the fuel entering the furnace goes through a combustion reaction and a portion of the released heat (because of the heat loss) is transferred to the feed stream, increasing its temperature. In the new visualization of a furnace in this project, the following information should be conveyed to the user:

1. There are three streams entering the furnace: the fuel, air, and the feed, and two outlet stream: the exhaust and the hot stream (like what we can see in the conventional view of a furnace)
2. The fuel goes through a combustion reaction.



3. There is a heat loss; and thus, not all of the released heat is used for heating up the feed stream.
4. When the flow rate of the fuel to the furnace increases, and so does the released heat, the temperature of the outlet stream increment.
5. Increasing the feed flow rate results in a decrease in the temperature of the outlet stream.