Introducing Process Integration For Environmental Control in Engineering curricula
Introduction

This module about Process Optimization was produced under the Program for North American Mobility in Higher Education as part of the Process Integration for Environmental Control in Engineering curricula. It was produced by students at Texas A&M University (Daniel Grooms) and the University of Ottawa (Derek McCormak).
Purpose

The purpose of this module is to teach fundamental aspects of process optimization. Process optimization is a very important subject. If a process is not optimized, it will not use energy or raw materials efficiently, and ultimately not be as profitable. With increasingly stringent environmental regulations, and an ever increasing demand on natural resources, process optimization is necessary to operate responsibly and profitably. The goal of this module is to teach the student the basics of mathematical optimization and to introduce some more complex material to attempt to develop a solution formulation process.
Module Structure

This module is structured as three tiers, each with a specific goal. Each tier has several subsections.

**Tier I**: Mathematical Methods of Optimization

**Tier II**: Case Studies

**Tier III**: Optimization Design Problems
Tier I contains some of the most common mathematical methods used for optimization. Solved examples have been given with each method for the student to follow along with. The goal of this tier is to provide the student with a basic understanding of methods that are used to optimize functions.
Tier I Contents

Tier I contains the following subsections:

1.1: Introduction
1.2: Linear Programming
1.3: Nonlinear Programming
1.4: Multi-Objective Optimization
Tier II

Tier II contains some more specific cases. The first subsection introduces the student to Lingo optimization software, a program that is very user friendly and available online as a free trial version. The second subsection details a specific case, the optimization of a heat exchange network. The purpose of this tier is to introduce the student to broader optimization material.
Tier II contains the following subsections:

2.1: Lingo Optimization Software
2.2: Heat Exchange Network Optimization by Thermal Pinch Analysis
Tier III

Tier III contains some examples for the student to work on. Solutions have been given. The purpose of this tier is to provide the student with some practice at solving optimization problems, with the emphasis being more on the formulation of a solution than on the actual mathematics involved.
Tier III Contents

Tier III contains the following subsections:
3.1: Sample Problems