

2. Transfer Line Dynamics

Introduction

We are concerned with modeling the transfer line used to transport a volatile and corrosive liquid from a high pressure storage tank to a tank car. (See the accompanying sketch.) The line is first hooked up and then, in normal operation, the valve (B) at the tank car is opened. After that the one (A) at the storage tank is opened. If valve A is opened first, however, the resulting pressure surge might rupture the line. (*You should explain why is there a pressure surge.*) Therefore, the transfer line has to be sufficiently strong to withstand the transient that occurs if the valve at the storage tank is opened first.

The particular problem we want to solve is: what is the peak pressure that occurs in the transfer line if the storage tank valve is opened first, and how does it depend on the line length, the driving pressure and other parameters.?

Experiment

A simulated storage tank containing water pressurized by air, and a transfer line system have been constructed. To start with, the transfer line will have only air in it. The storage tank valve is to be opened and the peak pressure determined at a point close to the tank car valve. You are to explain the nature of the pressure transient and to show how, and to what accuracy, you can calculate this pressure. An additional transfer line (of different length and with an extra “180° bend”) is also provided so that you can have another set of data.

Report

Your report is to be directed to the chief of the stress analysis section and state clearly how one should calculate the peak pressure.

