

# Abstract

Development of temperature controlled packaging (TCP) systems involves a significant lead-time and cost as a result of the large number of tests that are carried out to understand system performance in different internal and external conditions.

This MPhil project aims at solving this problem through the development of a transient spreadsheet based model using lumped system approach that predicts the performance of packaging systems under a wide range of internal configurations and dynamically changing environmental thermal conditions.

Experimental tests are conducted with the aim of validating the predictive model. Testing includes monitoring system temperature in a wide range of internal configurations and external thermal environments.

A good comparison is seen between experimental and model predicted results; increasing the mass of the chilled phase change material (PCM) in a system reduces the damping in product performance thereby reducing the product fluctuations or amplitude of the product performance curve. Results show that the thermal mathematical model predicts duration to failure within an accuracy of  $\pm 15\%$  for all conditions considered.

Keywords: Cold chain packaging system, predictive model, lumped system approach