

Indian Institute of Technology, Kharagpur

Optimal Control of Seeded Batch Crystallizer

by

Author Name

A thesis submitted in partial fulfillment for the
degree of Doctor of Philosophy

in the

Faculty Name

Department of Chemical Engineering

April 2018

Declaration of Authorship

I, AUTHOR NAME, declare that this thesis titled, 'THESIS TITLE' and the work presented in it are my own. I confirm that:

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“Write a funny quote here.”

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Doctor of Philosophy

by Author Name

The Thesis Abstract is written here (and usually kept to just this page). The page is kept centered vertically so can expand into the blank space above the title too...

Acknowledgements

The acknowledgements and the people to thank go here, don't forget to include your project advisor...

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Abbreviations

LAH List Abbreviations **Here**

Physical Constants

Speed of Light $c = 2.997\,924\,58 \times 10^8 \text{ ms}^{-\text{s}}$ (exact)

Symbols

a	distance	m
P	power	W (Js^{-1})
ω	angular frequency	rads^{-1}

For/Dedicated to/To my...

Chapter 1

Introduction

Batch crystallization is widely used in chemical, pharmaceutical, photographic, and other manufacturing processes for the preparation of crystalline products with several desirable attributes.

The batch system helps to obtain a narrower Particle size distribution (PSD) with high crystal purity. The crystallization process has an influence on the downstream processing and, hence, reproducible PSD in each operation is of prime importance. Thus, it is essential to find the variables affecting the process and control them within an acceptable range, so as to satisfy the final product quality requirements. Considering the operation of crystallizers, a batch process is preferable as a larger mean crystal size and narrower Crystal size distribution (CSD) can be achieved. In general, the CSD which is typically characterized by the mean and variance of crystal size is a key property to control this process because it directly affects final product qualities. Therefore, finding effective control strategy to obtain the crystals with a desired CSD is significant in order for improving the performance of batch crystallization processes and at the same time reducing difficulties in downstream processing. In the following work we formulate the problem using the population balance equations and obtain the solution for the optimal Temperature profile using Deterministic and Probabilistic methods

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Latex Tutorial Tushar Gupta 13CH30023 6th April 2018

Hello World !

1.1 Section

1.1.1 Subsection

1.1.1.1 1

Learning about subsections

Learning about paragraphs

1.1.1.2 2

1.1.2 Subsection

Testing the align feature

$$f(x) = x^2$$

$$f(x) = x^4$$

$$f(x) = x^5$$

$$f(x) = \left(\frac{1}{\sqrt{x}}\right)$$

1.2 Table Section

Testing table