

## Advanced CFD modelling of pulverised biomass combustion

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**ABSTRACT:** In this paper, the development and application of a CFD model for pulverised biomass combustion is presented. As a first step, the Discrete Phase Model (DPM) of the commercial CFD software FLUENT, originally developed for the combustion of pulverised coal, was investigated regarding its capability to predict pulverised biomass combustion. Based on these investigations, a more detailed sub-model for the devolatilisation part of the combustion process, was included. Furthermore, the original DPM energy equation for a single particle was modified in order to account for the temperature-dependent specific heat capacity of a particle. This modification allows for a more accurate prediction of the temperature of a single particle (until the inert state of fly ash) along its trajectory. The validation of the modified DPM for thermally thin particles was performed with a 2 D numerical simulation of a pulverised wood flame in a vertical tube furnace. As a first engineering application, a 3D simulation of a wood dust-fired biomass underfeed stoker furnace was successfully performed. During operation it was observed, that a part of the fuel particles, which were apparently too small for fixed bed combustion, were entrained and burned out "on-the-fly". This effect seemed to be the reason for high temperatures and ash slagging at the upper wall of the primary combustion chamber. In order to investigate this phenomenon, the extended DPM was applied in combination with an earlier developed CFD model for biomass grate furnaces. With the simulations performed, the entrained fuel particles could be identified to be the reason for the slagging problems. The developed model showed to be a valuable design tool for pulverised biomass combustion furnaces, but further extensions of the model are necessary and ongoing in order to appropriately describe the particle combustion process.

### INTRODUCTION

CFD analysis has been successfully applied for the design and optimisation of several biomass grate furnaces [10, 12]. Being interested in applying the same tool in a numerical study of pulverised biomass furnaces, the Discrete Phase Model (DPM) of the commercial CFD software FLUENT 6 was investigated regarding its capability to predict pulverised biomass combustion. The DPM, originally developed for the combustion of pulverised coal, is based on the assumption of thermally thin particles.

# Advanced Cfd Modelling Of Pulverised Biomass Combustion

**D Keegan**



## **Advanced Cfd Modelling Of Pulverised Biomass Combustion:**

Reviewing **Advanced Cfd Modelling Of Pulverised Biomass Combustion**: Unlocking the Spellbinding Force of Linguistics

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## **Table of Contents Advanced Cfd Modelling Of Pulverised Biomass Combustion**

1. Understanding the eBook Advanced Cfd Modelling Of Pulverised Biomass Combustion
  - The Rise of Digital Reading Advanced Cfd Modelling Of Pulverised Biomass Combustion
  - Advantages of eBooks Over Traditional Books
2. Identifying Advanced Cfd Modelling Of Pulverised Biomass Combustion
  - Exploring Different Genres
  - Considering Fiction vs. Non-Fiction
  - Determining Your Reading Goals
3. Choosing the Right eBook Platform
  - Popular eBook Platforms
  - Features to Look for in an Advanced Cfd Modelling Of Pulverised Biomass Combustion
  - User-Friendly Interface
4. Exploring eBook Recommendations from Advanced Cfd Modelling Of Pulverised Biomass Combustion
  - Personalized Recommendations
  - Advanced Cfd Modelling Of Pulverised Biomass Combustion User Reviews and Ratings

- Advanced Cfd Modelling Of Pulverised Biomass Combustion and Bestseller Lists
- 5. Accessing Advanced Cfd Modelling Of Pulverised Biomass Combustion Free and Paid eBooks
  - Advanced Cfd Modelling Of Pulverised Biomass Combustion Public Domain eBooks
  - Advanced Cfd Modelling Of Pulverised Biomass Combustion eBook Subscription Services
  - Advanced Cfd Modelling Of Pulverised Biomass Combustion Budget-Friendly Options
- 6. Navigating Advanced Cfd Modelling Of Pulverised Biomass Combustion eBook Formats
  - ePub, PDF, MOBI, and More
  - Advanced Cfd Modelling Of Pulverised Biomass Combustion Compatibility with Devices
  - Advanced Cfd Modelling Of Pulverised Biomass Combustion Enhanced eBook Features
- 7. Enhancing Your Reading Experience
  - Adjustable Fonts and Text Sizes of Advanced Cfd Modelling Of Pulverised Biomass Combustion
  - Highlighting and Note-Taking Advanced Cfd Modelling Of Pulverised Biomass Combustion
  - Interactive Elements Advanced Cfd Modelling Of Pulverised Biomass Combustion
- 8. Staying Engaged with Advanced Cfd Modelling Of Pulverised Biomass Combustion
  - Joining Online Reading Communities
  - Participating in Virtual Book Clubs
  - Following Authors and Publishers Advanced Cfd Modelling Of Pulverised Biomass Combustion
- 9. Balancing eBooks and Physical Books Advanced Cfd Modelling Of Pulverised Biomass Combustion
  - Benefits of a Digital Library
  - Creating a Diverse Reading Collection Advanced Cfd Modelling Of Pulverised Biomass Combustion
- 10. Overcoming Reading Challenges
  - Dealing with Digital Eye Strain
  - Minimizing Distractions
  - Managing Screen Time
- 11. Cultivating a Reading Routine Advanced Cfd Modelling Of Pulverised Biomass Combustion
  - Setting Reading Goals Advanced Cfd Modelling Of Pulverised Biomass Combustion
  - Carving Out Dedicated Reading Time
- 12. Sourcing Reliable Information of Advanced Cfd Modelling Of Pulverised Biomass Combustion
  - Fact-Checking eBook Content of Advanced Cfd Modelling Of Pulverised Biomass Combustion
  - Distinguishing Credible Sources

13. Promoting Lifelong Learning
  - Utilizing eBooks for Skill Development
  - Exploring Educational eBooks
14. Embracing eBook Trends
  - Integration of Multimedia Elements
  - Interactive and Gamified eBooks

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