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Phase-field simulations of cemented carbide inserts

Introduction

This project is done in cooperation with Sandvik Tooling's research and development department.

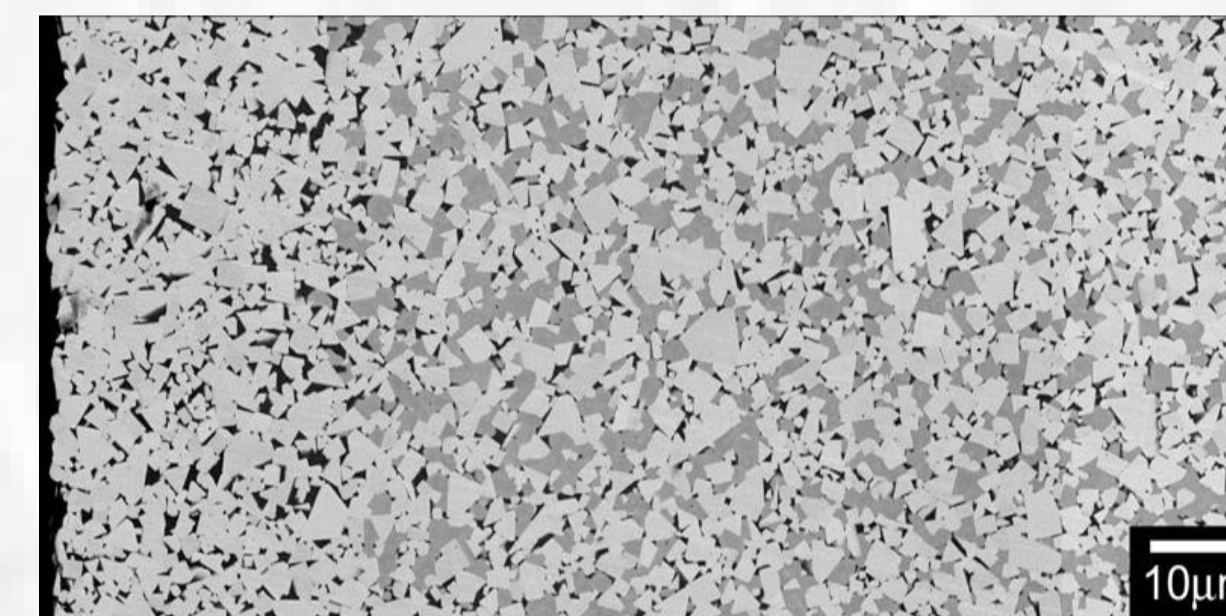
The work consider a simple model problem where one grain, due to a chemical driving force, is growing at the expense of another grain.

By first solving this problem in MATLAB it's possible to evaluate different software and tools, ranging from user-friendly commercial software to numerical FORTRAN libraries.

The results are presented below.

Microstructure

Since the microstructure to a large extent determines the properties of a material it is of importance to be able to predict the temporal evolution of the microstructure during processing of the material.



Microstructure in cemented carbide

FlexPDE

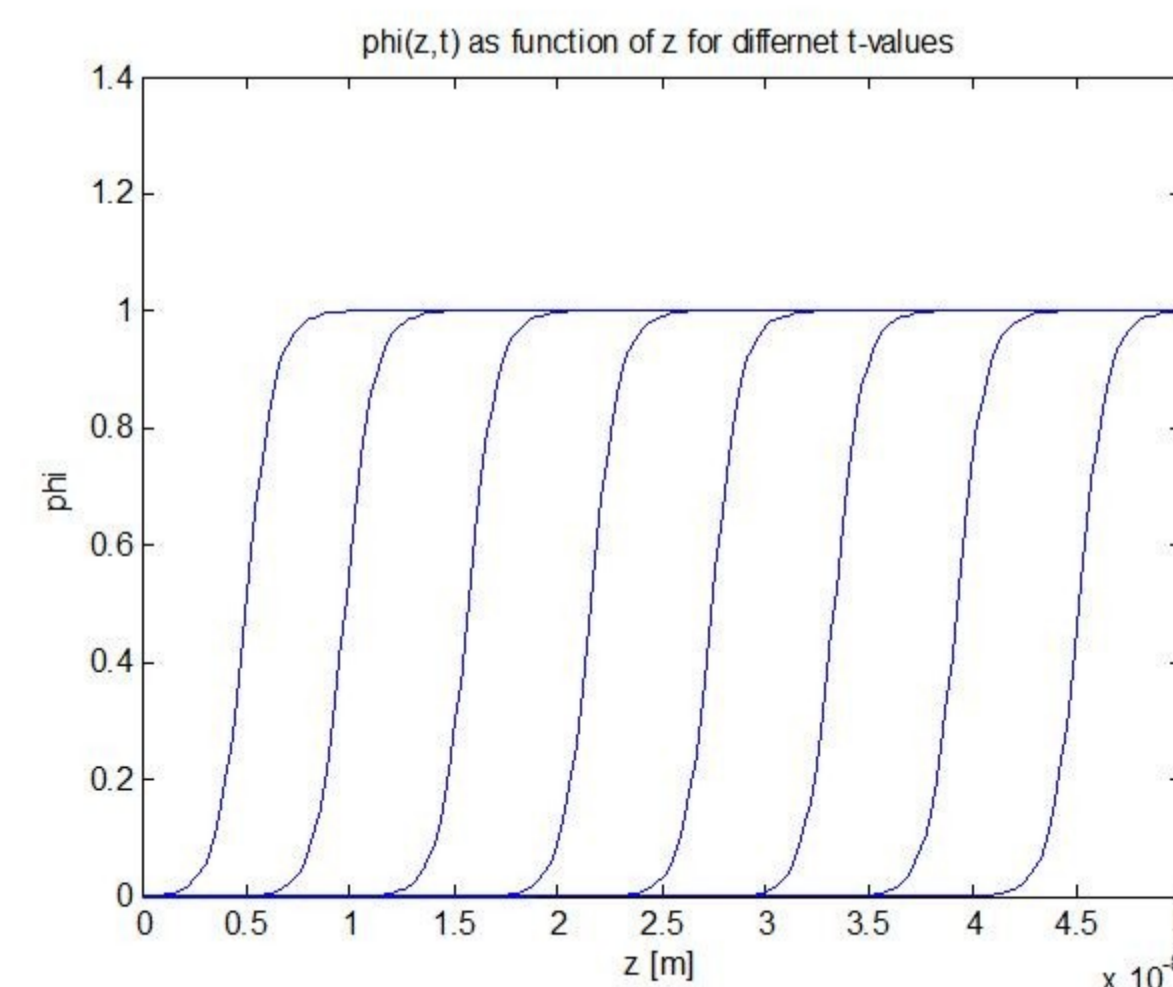
After investigation of different software products was flexPDE further studied.

FlexPDE is a software for obtaining numerical solutions to PDE in one, two or three dimensions. The program is based on the finite element method and can solve both steady-state or time-dependent problems.

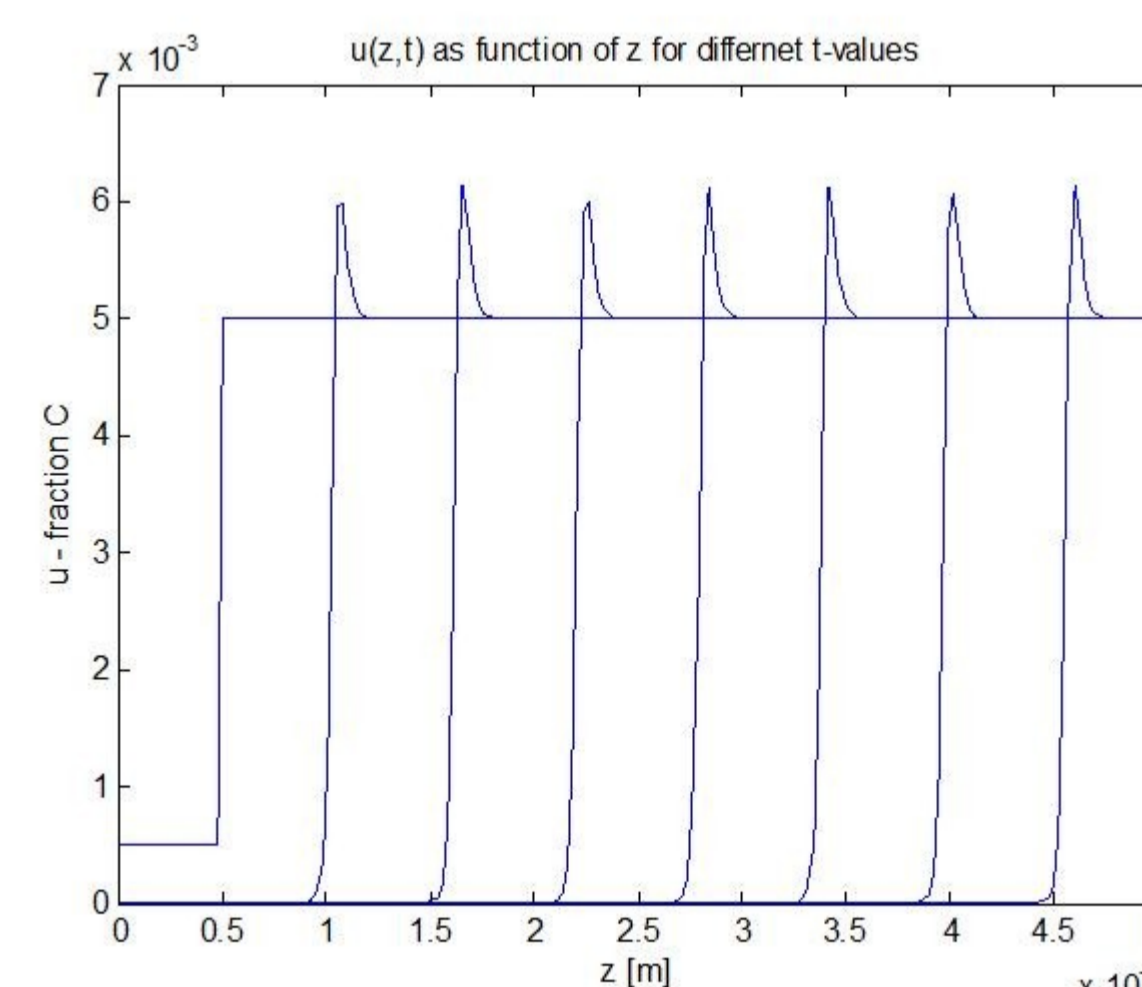
Conclusions

FlexPDE was appropriate to perform phase-field simulation. The program is a user-friendly program that is easy to understand and work with.

The software program's disadvantage is that it is not possible to change the algorithms that perform calculations which reduces flexibility and is not optimal for many problems.



Phase-field equation depending on the state in space z.



Diffusion equation depending on the state in space z.