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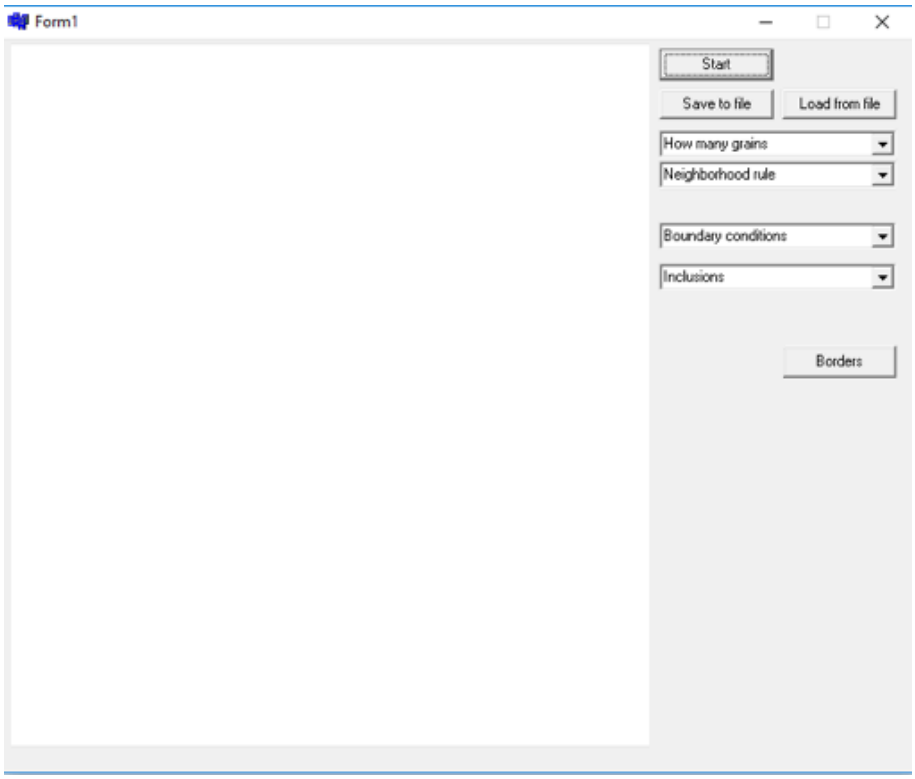
1st report Multiscale Modeling

Technology:

In this project I'm using a c++ programing language and c++ builder program to create interface (Picture 1)



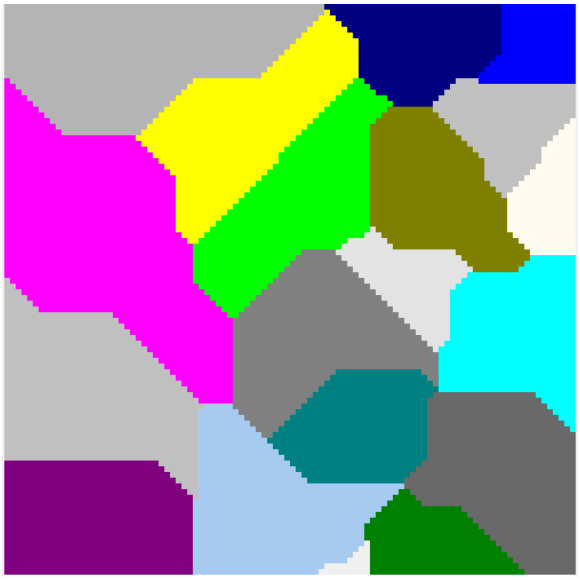
Picture 1 (Application Interface)

The purpose of the project was creating application for grain growth. The first application interface include a contains the neighborhoods method, a the second step we can add inclusion (circle and square) after and before simulation. The application can export simulation to txt and import to application from file. In the end my program have a option to generate a simulating grain growth border.

1. Grain growth:

In this step we can generate simulation using a Von Neumann (picture 2) and Moore method (Picture 3). The methods are checking the nearest cell and changing for another grain. How we can see, the both methods give us a very similar effects.

Picture 2 (Von Neumann)



Picture 3 (Monte Carlo)

2. Import generate microstructure picture to text file

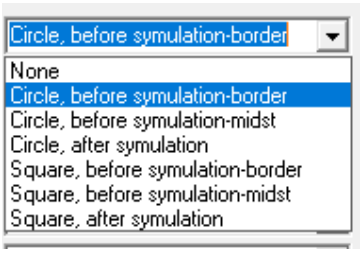
In this version of program we can import and export (picture 3) picture in txt. On the Picture 4 we can see a example of imported file.

Picture 3 (export and import option)

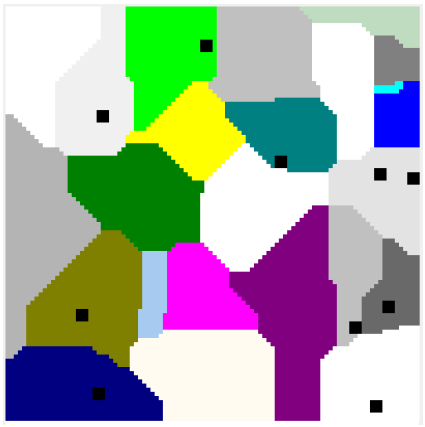
Picture 4 (example imported file)

3. Inclusion

On this step simulation you can add inclusion by clicking Square or Circle after or before generate microstructure (Picture 6), of course yo can change a size and number of inclusion using a border and mist inclusion situation (Picture 5)



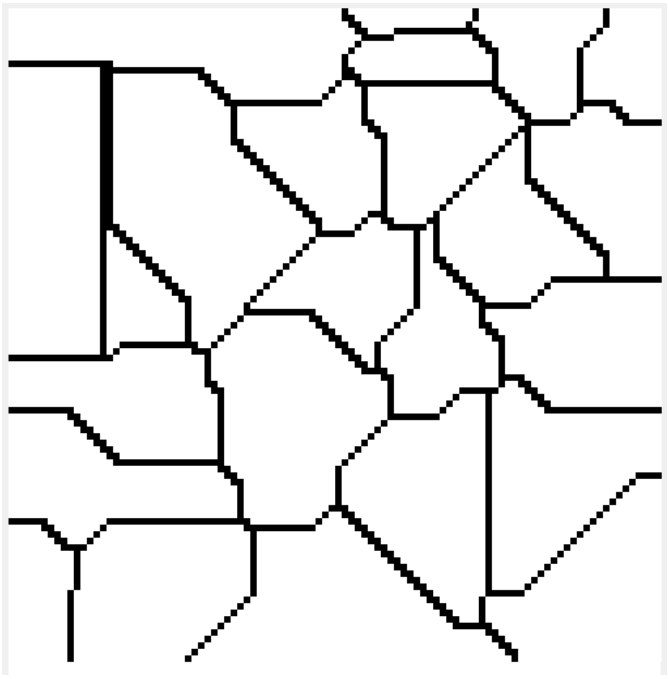
Picture 5 (inclusions option)



Picture 6 (examples of square inclusion midst)

4. Borders

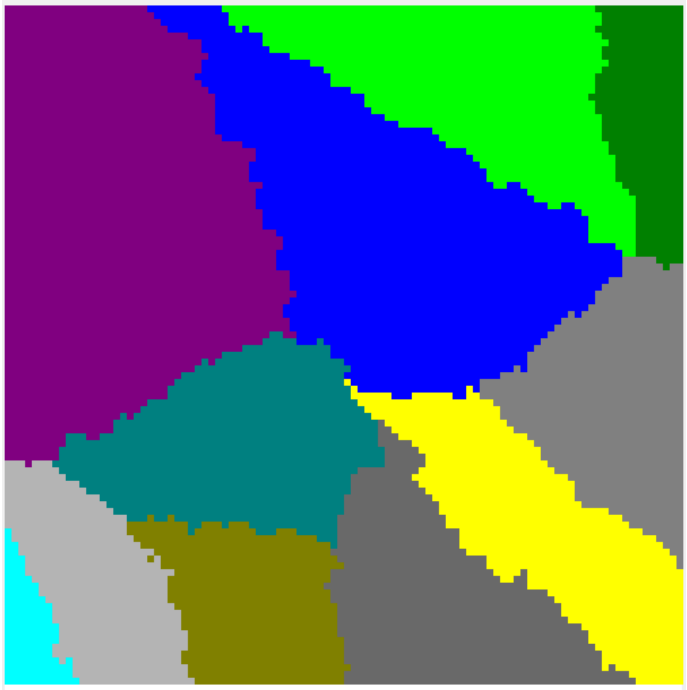
When the grains growth, my program can the cells and showing only the borders, example is on the picture 7



Picture 7 (grains borders)

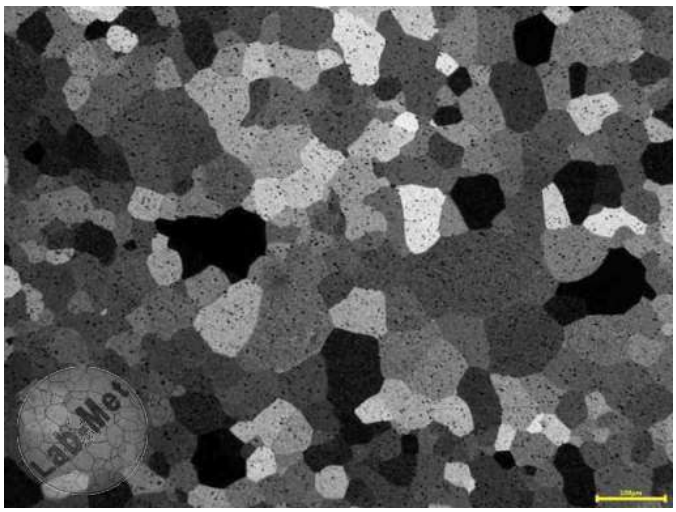
5. Extended Moore

This options allow to control in Moore method the shape borders from 10% to 100% (Picture 8)

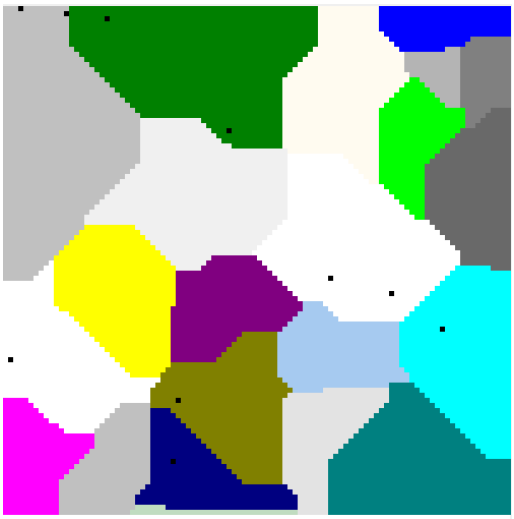


Picture 8 (Simulation Moore with of 30% probability)

6. Comparison of a generated microstructure vs real microstructure AlMgSi



Picture 9 (AlMgSi microstructure)



Picture 10 (Simulated microstructure)

Comparing the microstructures, we see that they look alike. On the Picture 9 is a truth AlMgSi and on the Picture 10 is a simulated microstructure from my application. We can see a really similar grain on the both pictures, and inclusions.

7. Summary

The project was designed to generate microstructure. By going through several steps you can create a fully optimized neighborhood generator such as von Neumann or Moore method. The implemented application makes basic design assumptions, but many elements need to be improved and optimized so that in the future the application could serve as a scientific aid in understanding this issue.