Simulation of the air flow in the MI building with LBM

CFD Lab Project: midterm presentation

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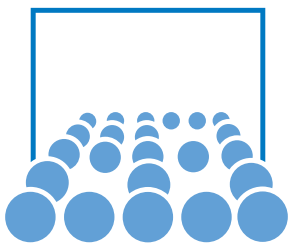

Contents

What we want to do

We want to simulate the airflow in a complex geometry with LBM.
Why not our building?!
It may be quite a big scale but... let's try it!

What we need

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- The geometry of the building
- Boundary conditions (types, parameters)
- Flow parameters (viscosity, Reynolds)

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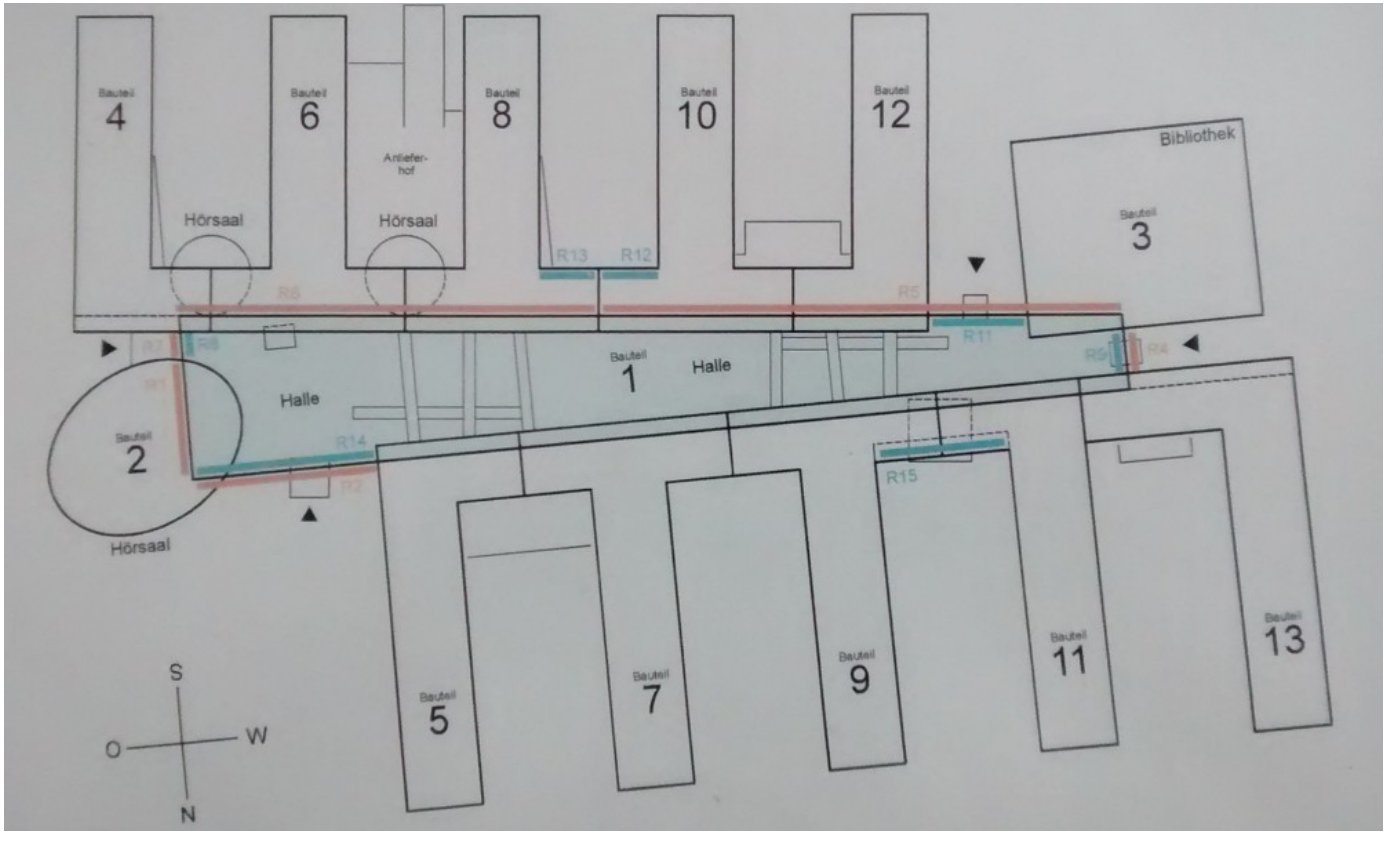
- We need all these dimensionless!
- And we also need a fine grid...

What we need (2)

Because we need a fine grid, we will need a parallel approach.
So we also need:

- To **merge** our parallel and our arbitrary-geometries code
- To invent a way of **separating the complex domain**
- To **balance the work** among different processors
- To effectively **transfer information** between different subdomains

How to extract the geometry?



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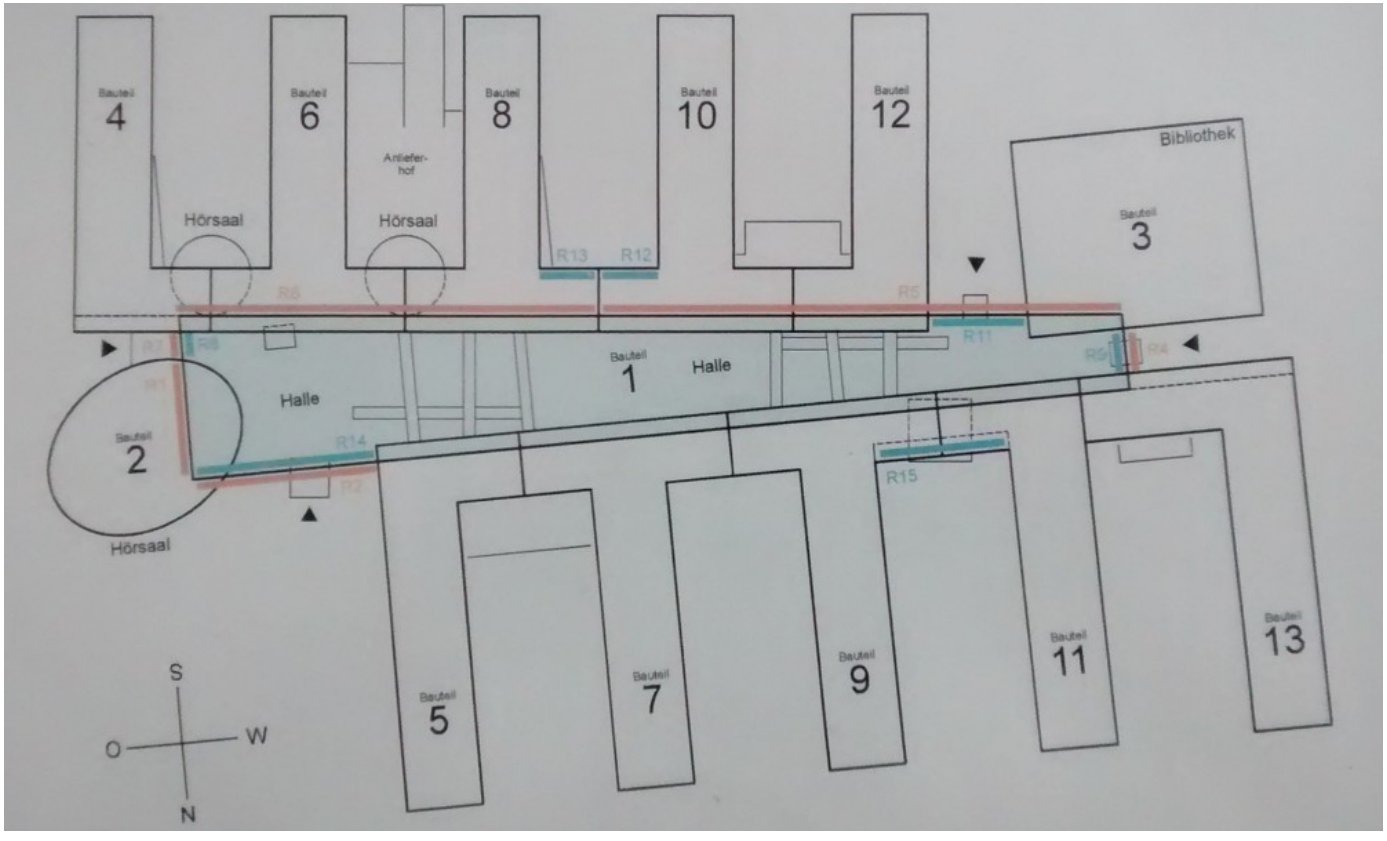
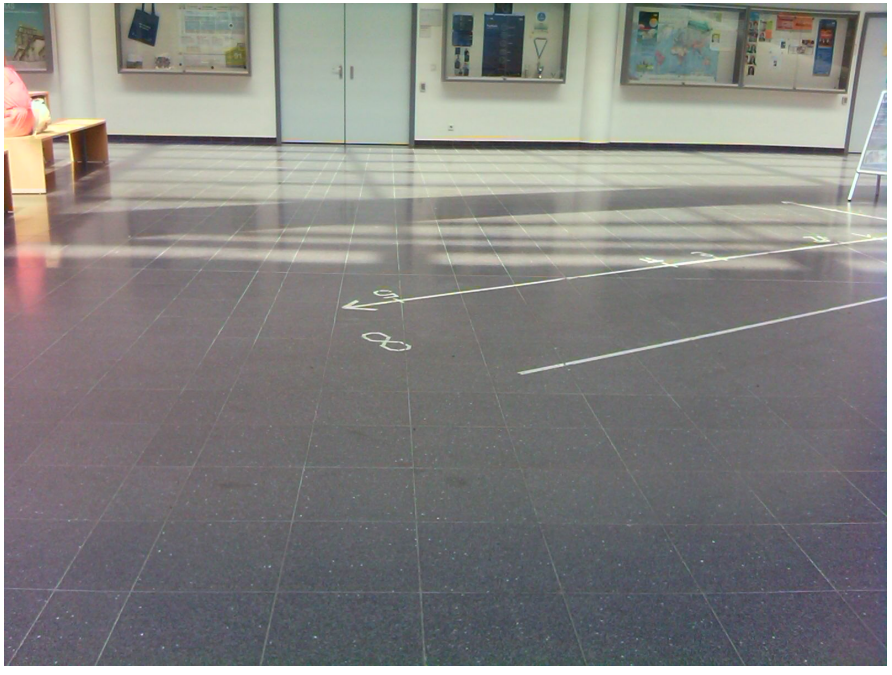


Well, we are assuming some simplifications...

How to know the sizes?



Size of the main hall: on average 150m length, 19m width

Complex geometry in the code

How to define the geometry, the flagfield for such a complex geometry?

- Use an external script to set the flagfield for every subdomain
- Set different flags for the different boundaries

Challenges

- How to separate such a complex geometry?
  - Approach #1: Focus on the specific scenario and specific values for number of processes
  - Approach #2: Divide the geometry to smaller blocks and assign multiple blocks to each processor (how to optimize communication?)
- How to define the connections between the blocks?
- How to deal with the multiple boundary conditions?

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- How to deal with the multiple boundary conditions?
- Can we solve a fine-enough grid on our laptops?

Thank you!

We are open for questions and ideas!