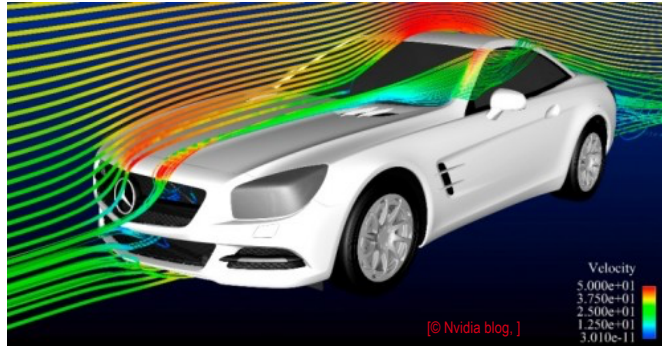


Interactive GPU-based Flow Simulation

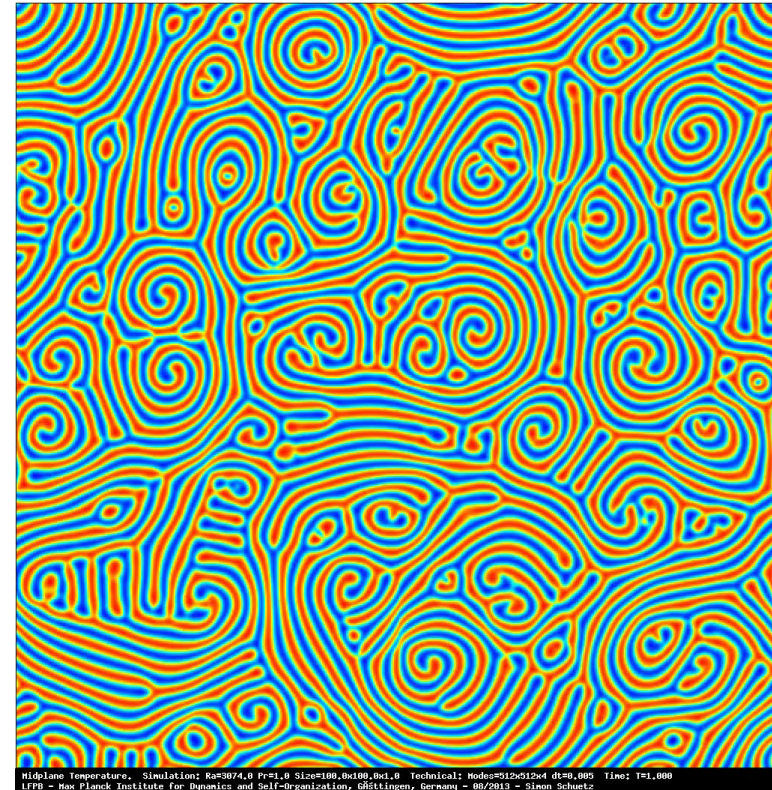
Tobias M. Schneider, Simon Schütz
EPFL STI IGM ECPS

GPU-based Flow Simulation - Project

Dream: Interactive flow simulation for design



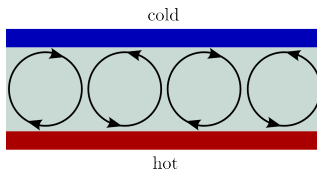
Dynamics (top view)



Needed: - fast computers
- interactive input



Simpler system: Convection between two plates

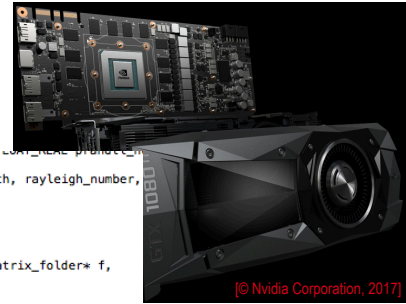


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Wanted: Interactive 'stirring' of the flow

GPU-based Flow Simulation – Tasks and Requirements

- Configure Drivers to compile/run CUDA/C++ code
- Modify **CFD code** for interactive input
- Design **Graphical Output**
- **Touchscreen** for input?



```
237     Coeff<double>6 p_coeff, CUDA_FLOAT_REAL delta_t){
238     linear_implicit_operator* op = new linear_implicit_operator(dimension, cube_length, rayleigh_number,
239     prandtl_number, p_coeff, delta_t);
240     return op;
241 }
242
243 matrix_folder* linear_implicit_operator::calculate_operator(matrix_folder* theta, matrix_folder* f,
244     matrix_folder* g, matrix_folder* F, matrix_folder* G){
245
246     int columns = theta->get_matrix(0)->get_matrix_size(0);
247     int rows = theta->get_matrix(0)->get_matrix_size(1);
248     int matrices = theta->get_matrix(0)->get_matrix_size(2);
249
250     int F_columns = F->get_matrix(0)->get_matrix_size(0);
251     int F_rows = F->get_matrix(0)->get_matrix_size(1);
252     int F_matrices = F->get_matrix(0)->get_matrix_size(2);
253
254     CUDA_FLOAT_REAL* row_theta_col_theta = row_theta_col_theta_device->get_data();
255     CUDA_FLOAT_REAL* row_theta_col_f = row_theta_col_f_device->get_data();
256
257     CUDA_FLOAT_REAL* row_f_col_theta = row_f_col_theta_device->get_data();
258     CUDA_FLOAT_REAL* row_f_col_f = row_f_col_f_device->get_data();
259
260     //input data matrices
261     matrix_device* theta_matrix = theta->get_matrix(0);
262     CUDA_FLOAT* theta_data = theta_matrix->get_data();
263     matrix(0);
264     _data();
265     matrix(0);
266     _data();
267     matrix(0);
268     _data();
269     matrix(0);
270     _data();
271 }
```

