PAUL SCHERRER INSTITUT

PSI

ETH zürich

Tobia Claglüna :: AMAS Group, LSM

IPPL Meeting

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Contact: tobia.clagluena@psi.ch

Emergent Identities: Gaussian Test-Case

Initial probability density: $f(r) = \mathcal{N}(\mu, \sigma) = \mathcal{N}(0, 1) = \frac{1}{\sqrt{8\pi^3}} \exp\left(-\frac{r^2}{2}\right)$

What identities currently hold:

- ☑ $h(r) = \frac{2}{r}\ \mathrm{erf}(\frac{r}{\sqrt{2}})$
- ☑ $g(r) = \left[\sqrt{\frac{2}{\pi}} \exp\left(-\frac{r^2}{2}\right) + (r + \frac{1}{r})\ \mathrm{erf}(\frac{r}{\sqrt{2}})\right]$
- ☑ $F_d = \Gamma \nabla h(r) = \Gamma \frac{2}{r^2} \left[\frac{1}{r}\mathrm{erf}(\frac{r}{2}) - \sqrt{\frac{2}{\pi}} \exp\left(-\frac{r^2}{2}\right)\right]$
- ☑ $Tr(\boldsymbol{D}) = \Gamma \nabla^2 g = \Gamma h$
- ☐ $\nabla \cdot \boldsymbol{D} = \nabla \cdot (\Gamma \nabla \nabla g) = \Gamma \nabla \nabla^2 g = F_d = \Gamma \nabla h$

Conclusion:

- Our solutions of the off-diagonals of $\boldsymbol{D}$ are incorrect
- The analytical solution computed with Mathematica of either one coefficient is wrong

D-Field Analysis: Gaussian Test-Case

Solver result looks similar to what we've seen in the Maxwellian.

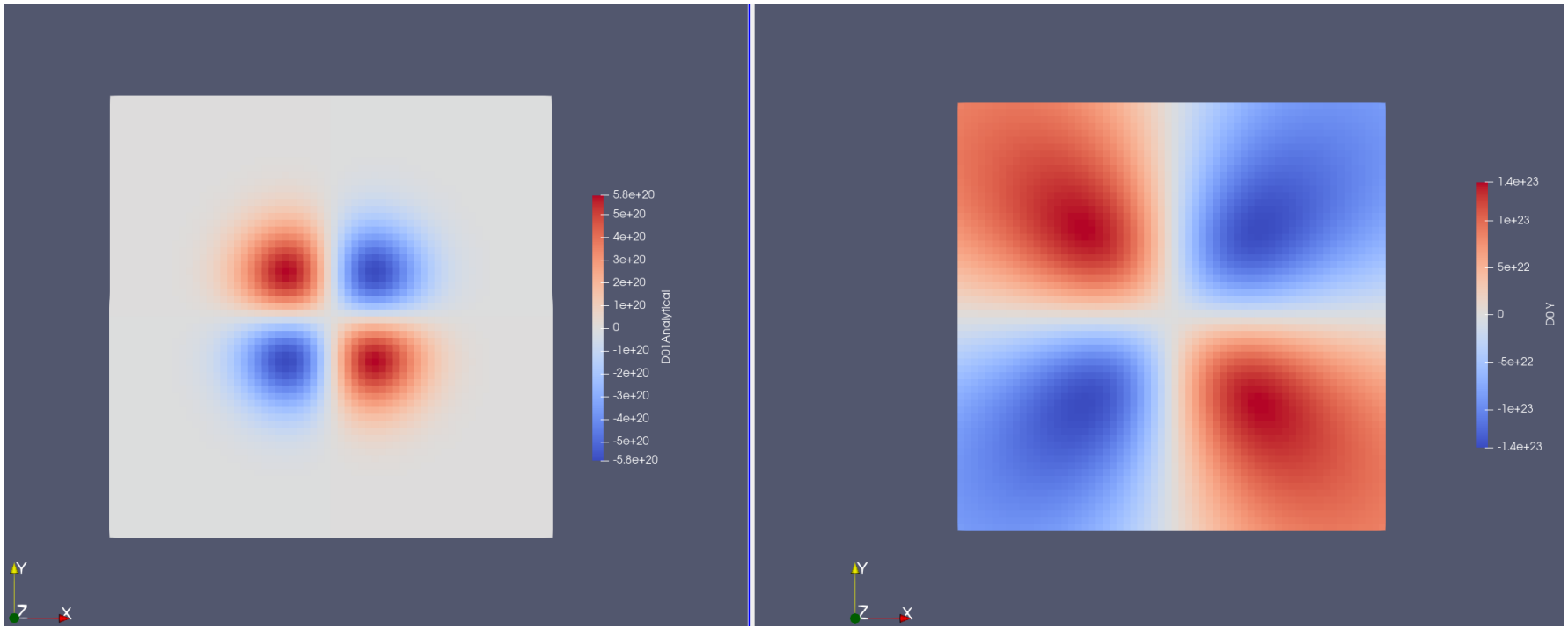

Figure 1: $\boldsymbol{D}_{xy}$ comparison (different colorbar ranges!)

TODO

- ☐ Make off-diagonals of $\boldsymbol{D}$ coincide with analytical solutions
- ☐ Create convergence plots for these coefficients
- ☐ Start assembling a list of the results I've gathered in the last 4.5 months
- ☐ [Onesided Hessian]

(Adjusted) Timeline

Date	Target Goals
16/05	Setup v-space datastructures in `LangevinParticles.hpp`. Add Friction coefficient. Add Solver for 2nd Rosenbluth potential $g(\vec{v})$.
23/05	Analyse structure of $\boldsymbol{D}$. Finish Diffusion coefficient computation (via onesided Hessian operator).
30/05	Analyse interplay between collision coeff.'s (see whether Severin's conclusions are confirmed or can be disproved).
	Profiling of runtime and memory consumption.
06/06	Start improving most pressing bottlenecks. Start writing.
17/07	Submission.

Table 1: Timeline with approximate milestones